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Appoint a Shipbuilder to the Council of National Defense

SHIPBUILDING in the United States has become one of the most vital functions of the nation in forging its weapons for war. Under these conditions American shipbuilders are unanimously agreed that the industry which they represent should have a voice in shaping the war policies of the government through representation in the Council of National Defense. Other great war industries, such as munition making, coal mining and transportation, have been represented by recognized experts in the Council since its formation, and now that a petition has been sent to President Wilson by the Society of Naval Architects and Marine Engineers, urging the appointment of a representative builder of merchant vessels as a member of the Council, it is to be hoped that the shipbuilding industry may also receive its due recognition.

Constructive Criticism

AT the naval architects' annual banquet, J. W. Powell, vice-president in charge of sales and operations of all the great shipyards owned and controlled by the Bethlehem Steel Company, clearly outlined the difficulties which are confronting American shipbuilders to-day. Not content with pointing out the difficulties, however, Mr. Powell went further and offered three valuable suggestions which, if followed, it is believed will go far towards overcoming these difficulties.

The first of these suggestions, which advised the appointment of a representative builder of merchant vessels on the Council of National Defense, was favorably received by the shipbuilders, and, as a result, the Society has petitioned the President of the United States to make such an appointment.

The second suggestion referred to the confusion and unsatisfactory relations which have existed between shipbuilders and the Emergency Fleet Corporation and which have hampered the progress of the shipbuilding programme. As a contrast to these conditions, Mr. Powell described the harmonious relations existing between the Navy Department and those shipbuilders who are engaged in naval construction, and suggested that shipbuilders and officials of the Emergency Fleet Corporation seek some common ground on which their differences could be reconciled and strive to co-operate more fully in carrying out their common purpose. The recent appointment of a board of five members representing the Atlantic Coast Shipbuilders' Association gives a splendid opportunity for smoothing out the numerous difficulties and misunderstandings between the Fleet Corporation and the shipyards and will permit the shipbuilders to spend more time at home building ships and less time in Washington at fruitless conferences.

The third suggestion, which perhaps is the most important of all, referred to the labor question. Mr. Powell suggested that a nation-wide campaign should be instituted to stimulate the loyalty and patriotism of labor. Shipyard workers, from the president down to the humblest employee, must realize that in this crisis shipbuilding is a service comparable in every respect to actual military service. Upon the efforts of the shipbuilders depend the lives of the men who are now being sent to fight in France, as well as the ultimate victory to our arms. Personal ambition and selfish motives must be swept aside and the same self-sacrificing spirit which dominates the men who are preparing to lay down their lives, if necessary, for the future peace and security of our country must guide the shipyard workers in their gigantic task.

What is actually being done to recruit and train shipyard labor is outlined in several articles printed elsewhere in this issue, but, as Mr. Powell says, a national campaign of personal education should immediately be undertaken to get labor in line for the ending of the war. To start such a campaign the Bethlehem Shipbuilding Corporation has offered to head a list to defray its expenses with a generous subscription. No time should be lost in carrying out this admirably conceived undertaking and prompt support should be forthcoming not only from shipbuilders, but from every patriotic American citizen as well.

Gossip from Washington

GOSSIP from Washington informs us that a foreign classification society has in its employ a representative—note we do not use the word lobbyist—to whom is paid a salary two or three times as large as is paid to the best technical men connected with the society. If this gossip is true, it seems as though an explanation should be made by the society in question. If the gossip is not true, it should be publicly and promptly refuted.

Whether it is or is not true, there is no possible excuse for the Shipping Board or the Emergency Fleet Corporation to permit vessels built of American steel, in American shipyards, and paid for in American money, to be "classed" by anybody except a distinctly American classification society. The American Bureau of Shipping is a decidedly patriotic and unselfish American organization. It is not an organization for money-making. Indeed, the shipbuilders, shipowners, underwriters and others backing it go down into their pockets each year for many thousands of dollars to meet necessary expenses.

Compare with this a foreign classification society, whose American representatives have little or no further authority than to send American plans and specifications, to say

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nothing of American money, across the ocean. The money never comes back, but plans and specifications do, although in far too many instances they have been held back not only weeks, but months, to the great disadvantage of the American shipowners and shipbuilders. America can never have a merchant marine if it is to be held up in this way, as it has in many, many years gone by, by foreigners who are not at all anxious to help build up an American Merchant Marine.

Just after the gossip came from Washington, announcement was made that the Emergency Fleet Corporation had arranged for foreign classification of many vessels. No business man who is anxious to build up a permanent business would dare turn a large percentage of his orders over to a rival who had shown every inclination to prevent his succeeding. Why, then, should the United States Government do this?

The rules of the American Bureau of Shipping are, as a whole, more scientific, more up-to-date, and better adapted to American ship interests than any rules designed to suit conditions in some other country. Furthermore, the inspection service of the bureau is more prompt and efficient, and better suited to American conditions than any inspection controlled by strings or wires pulled from the other side of the ocean. There is every reason, therefore, why American-built ships should be classified by an American classification society and by no other.

Unjust Discrimination by the Shipping Board

IN a circular recently issued by the Shipping Board calling for tenders for the installation of machinery and the completion of wooden hulls now building in the Northwest for their account, which involves considerable dry dock work, it was stated that the Emergency Fleet Corporation does not favor the use of marine railways for this purpose. While objections to the docking of ships on some of the old-fashioned marine railways still in existence, which were built before sound engineering principles were applied to this class of marine construction, are undoubtedly just and well founded, nevertheless it is astounding that the construction department of the Emergency Fleet Corporation should discriminate entirely against the use of marine railways as a class. Modern railway dry docks are being widely used throughout the United States for the highest grade of work. One firm alone has built no less than 110 of these railway dry docks and they are being called for with increasing frequency from all over the world. The Navy Department is docking their largest destroyers and other vessels on these docks in different parts of the country, and is at present preparing to build several of them in the navy yards for docking vessels up to 350 feet in length. Modern railway dry docks are examples of some of the finest and most reliable engineering work that can be found, and any discrimination against their use by the Shipping Board can be accounted for only by complete ignorance of up-to-date dry dock engineering practice. This unjust discrimination should be promptly withdrawn by the Shipping Board, as under the present conditions every dry dock that is safe and properly designed is sorely needed.

An Ill-Advised Requirement

ONE of the regulations designed to reduce the visibility of merchant vessels, which is now under discussion by the Ship Protection Committee of the Shipping Board, provides that all steam vessels sailing from the United States for the war zone must carry a sufficient supply of anthracite coal to carry the vessel for not less than two daylight periods, and that this coal must be used during the daylight runs while within the war zone. While the purpose of this regulation is commendable, the results sought are not likely to be accomplished if the rule is put into force. In the first place an unlimited supply of anthracite coal is not available in many of the United States ports from which vessels are constantly sailing for the war zone, and in all probability difficulties will be experienced in furnishing an adequate supply for every vessel, especially in Southern ports, resulting in delays in sailings. Even if the supply of anthracite did not enter into the question there is a more serious disadvantage which must be faced, due to the fact that, on vessels with boilers operating on natural draft, anthracite cannot be burned at a sufficiently high rate to keep the vessel at her normal speed. On an American liner, for instance, the change from bituminous to anthracite coal reduced the speed of the vessel two knots. As speed is fully as essential as low visibility in escaping submarine attack, it would appear that whatever advantage would be gained in one direction would be offset by losses in another. Furthermore, the average fireroom crew lacks experience and skill in burning anthracite coal, and this factor will undoubtedly have an adverse effect on the steaming power of the vessel. In all probability better results would be obtained by more careful training of the firemen in the smokeless combustion of bituminous coal, for under careful supervision and with proper conditions in the furnaces the production of smoke can be greatly lessened and at the same time full speed maintained.

The Future of Tank Ship Construction

A SERIOUS shortage of American tank steamer tonnage is forecasted by Robert W. Morrell, superintendent of hull construction of the Standard Oil Company of New Jersey, in a paper presented before the recent meeting of the Society of Naval Architects and Marine Engineers. Up to the present time, the United States Shipping Board has made no provision in its shipbuilding programme for the construction of tank steamers, nor will it permit anyone else to place orders for building tank ships, in spite of the fact that the transportation of oil to Europe during the war will be one of the most vital necessities, not only for our nation, but for our allies. All of the tank steamers now under construction in the United States totaling about 64 vessels of 575,750 tons deadweight, are for 1917 or 1918 delivery. When these vessels are completed, the building of tank ships will, according to present indications, be at a standstill in this country.

The total number of American tankers now in service is about 170, having a total gross tonnage of 823,200 and a total deadweight cargo capacity of 1,180,000 tons. This represents about 20 percent of the total steel American tonnage exclusive of that on the Lakes, but by the time the government shipbuilding programme is completed it will represent a very much smaller proportion of our merchant tonnage.

As the requirements for oil in the navy and by our forces abroad will rapidly increase during the war, it is a serious mistake on the part of the Shipping Board to exclude tank ship construction in its shipbuilding programme. Without seriously interfering with the present programme, provision could be made for the construction of at least a limited number of tank vessels of standard type to be taken in hand as soon as the vessels now under construction leave the ways.

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LETTERS TO THE EDITOR

"The Return to the Reciprocating Engine"

The undersigned has read with interest the article, "The Return to the Reciprocating Engine," as published in the November issue. This would seem to be the viewpoint of the situation as it might appear to one interested in turbine equipment, and would it not, therefore, be in order to offer the following criticism, or, if preferable, remarks from another standpoint somewhat, it is hoped, more impartial? In this connection it is felt advisable to preface what follows by the statement that the principals of the undersigned manufacture *both* reciprocating and turbine engines; also that the views now put forward are purely personal.

Exception is taken to the statement that "the turbine is obviously better adapted for this duty (continuous running, marine service) than the reciprocating engine," and it is open to question whether foreign navies "have appreciated this fact and have switched over from reciprocating engines to turbines wherever possible for this one reason." It is quite agreed that reliability is of paramount importance in all marine work, but to couple this remark with the above statement is a very broad and positive asssrtion which, in the opinion of the undersigned, lacks foundation. In foreign navies, as in the American navy, the turbine, as a prime mover, is, generally speaking, in favor, although not altogether on the ground of reliability; but it is felt, with all due consideration given as well to many other important factors, such as the saving in space and weight which results by its adoption for large units, economy in operation, etc. Also, and apart from the strictly engineering requirements, there are advantages resulting from the adoption which interest the naval architect in the way of armor belting, etc. It is, therefore, felt that to state that reliability alone is the reason for the adoption of the turbine is incorrect, as this question of turbine reliability is a very much discussed subject in marine circles where the majority of parties to such arguments appear willing to agree that the reciprocating engine does possess this feature. It is, rather, the reliability of the turbine which is so much discussed.

As for auxiliaries being driven, wherever possible, by turbines; this statement also is very much open to question and, as yet, European marine practice continues to favor the reciprocating engine both in naval and merchant work.

In respect to the third paragraph of the article and the question, "But will the men that will necessarily be called upon to operate these be really experienced with any types of engines?" Surely the writer of the article does not hold the opinion that the authorities at Washington are planning to spend vast sums in the construction of a merchant fleet and then calmly turn same over to be operated by men without experience! The efforts which are being made to undertake the training of junior engineers and the co-operation of the navy in arranging for the supply of skilled engineers furnishes an answer to this statement which, it is hoped, should be conclusive as to the intentions of the Washington administration. It is to be regretted that the training periods must necessarily be all too short; but this fact would apply in any event, whether the men were instructed in reciprocating engine practice or in turbine operation.

But why call the reciprocating engine "obsolete"? This is entirely wrong and unjust, and, should you publish this letter, it is felt that the majority of your readers will agree that it is so. The merchant service, at least, will hold to the reciprocating engine for many years to come, and to state that the reciprocating engine only holds its own in this country because the "gear-cutting capacity of the country is taxed to the limit" cannot be accepted as conclusive.

To revert to the auxiliaries again. Why, in an open article, does the author continually refer to the forced draft gear? In respect to the remarks which are made in connection with same, presumably whether turbine or reciprocating sets were made use of, they would operate under the same steam conditions, and therefore no matter where the exhausts were led to, the results would be the same. Further, in the matter of economy, it is felt that there would be little to choose, in sets of the size under discussion, between the modern totally enclosed forced lubrication engine and the turbine. Undoubtedly, the turbine draft gear would not require as much space and would be somewhat lighter, but does its present design meet with the requirements of steady and continuous running and does the usual type of fan supplied at these high speeds actually meet forced draft requirements?

The writer is inclined to hold the opinion that turbine-driven draft gear for marine purposes is not yet fully developed or accepted and would draw attention to the fact that his principals, Messrs. James Howden & Co., Ltd., of Glasgow, originators of the heated air system and probably the best known forced draft specialists in the world, have not yet put on the market a turbine-driven fan set. Is there not something significant in this? The writer thinks so, for surely Messrs. Howden, through this world-wide connection, would be in a position to judge very accurately and impartially, since they are builders both of reciprocating and turbine engines.

New York. F. S. B. HEWARD.

More Vessels Needed for Coastwise Shipping in the Philippines

The coastwise trade of the Philippines is carried on by some 326 vessels of all descriptions. These vary in size from vessels of 1,845 gross tonnage down to 3- or 4-ton launches. Twelve of these vessels are over 1,000 tons, 12 are between 500 and 1,000 tons, 47 are between 100 and 500 tons, and 255 are below 100 tons. Of the whole number, 138 ply from Manila as their home port, 42 operate from Cebu, 31 from Iloilo, 13 from Zamboanga, and 2 from Jolo. Many of the smaller vessels are wind driven.

The coastwise trade of the Philippines is of growing importance, owing to the fact that the archipelago is made up of so many islands. Manila, while not the only port of entry, is practically so, especially for imports. Staple cargo is shipped from Iloilo, Cebu and Zamboanga occasionally, and cargoes are sometimes received at these ports. But the rule is that the foreign commerce of the archipelago is conducted through Manila. Consequently, the coastwise vessels are kept busy collecting exports for Manila and distributing imports to the remoter islands. During 1916 several vessels heretofore engaged in the coastwise trade were withdrawn and sold for use in other parts of the world, this having been one of the effects of the great demand for tonnage created by the European war. At the present time more vessels are urgently needed.

Rates on coastwise vessels are controlled by the Public Utility Commission. The rise in coal prices and the cost of repairs and operation caused a general rise in rates during 1916.

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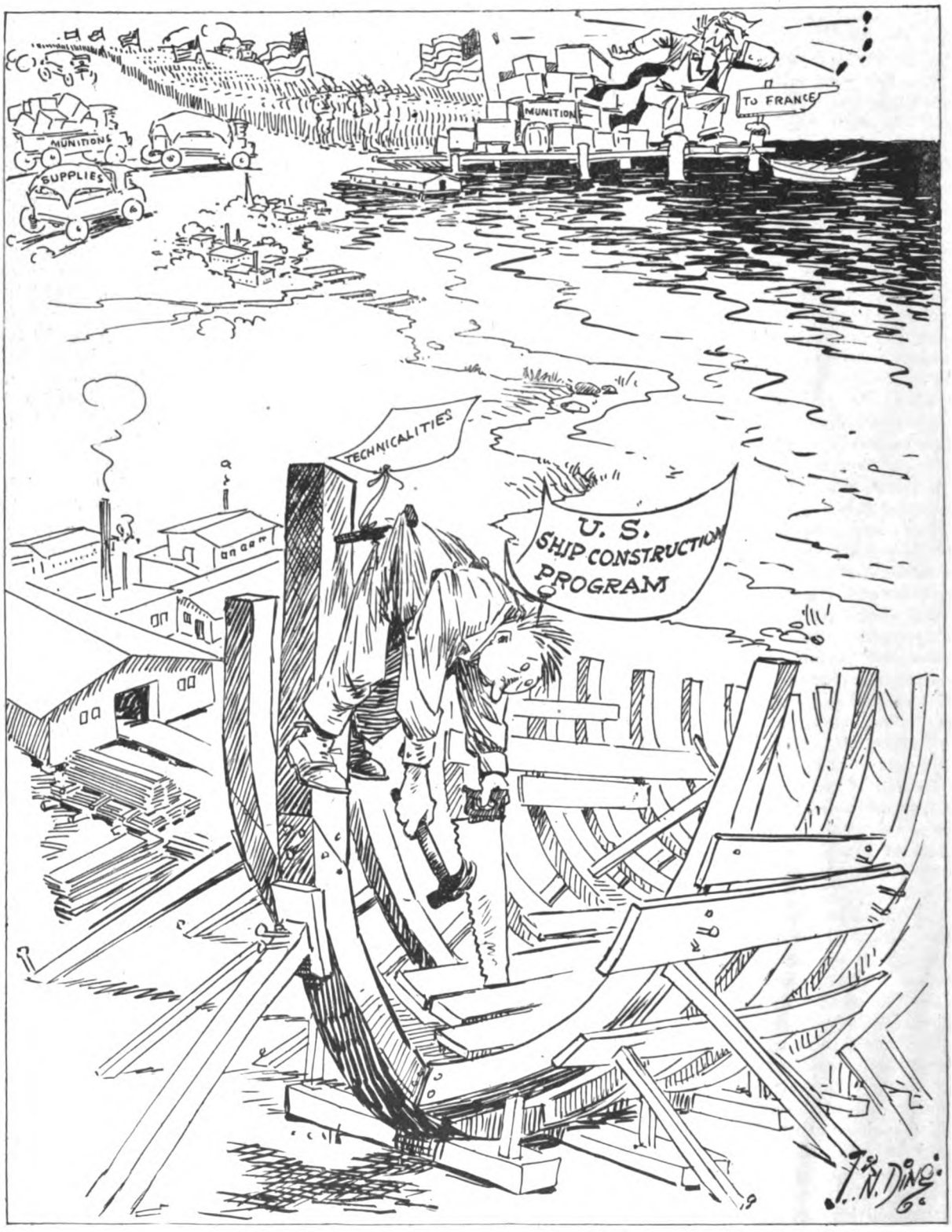
SHIPBUILDING PROGRAM DELAYED BY TECHNICALITIES

Cartoon Reproduced from the New York Tribune



Who's to Blame?

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American Merchant Marine Must Be Unhampered by Restrictions from which Our Competitors Are Free*

BY EUGENE P. THOMAS †

OUR country has had to pay dearly for our abject submission to the decay of our merchant shipping in foreign trade. But the lesson has been learned, and with it has come a recognition of these fundamental principles; we must be enabled to freight our products to foreign markets at a cost not exceeding that which will be available to our competitors, and this will be possible only if we have an American merchant marine unhampered by restrictions from which our chief competitors are free. The British Shipping Industry which for generations has been, and is still, by far the greatest in the world, was built up by the exertions of the men engaged in it. It prospered because it was free from restrictions to which its competitors were subject. Theories to the contrary notwithstanding, we cannot have, in time of peace, an American merchant marine worthy of the name unless it be profitable to operate it without subsidy or subvention. This is manifestly not possible upon any practical or permanent basis so long as it costs more to operate an American steamer in ocean-going commerce than a foreign steamer in the same trade. Unsubsidized steamers have always been able to make a better showing for their owners than the subsidized ones, and it is certain that while a large majority of the British lines have received no subsidies from their Government, they have nevertheless grown and prospered, and have found no difficulty in competing with the subsidized lines. I repeat that what is necessary for the future growth and success of the American merchant marine is that it be placed upon a footing of equality with its chief competitors; with a fair field and no favor, repealing all laws which experience has shown to be detrimental to its growth, thereby leaving American enterprise free to achieve a success equal to that which the British Shipping Industry, unhampered by restrictive laws, has been able to accomplish.

The present plans of the United States Shipping Board, involving the building of millions of tons of ocean-going steamers, are not of greater consequence to the future of the export and import trade of the United States than they are to the maintenance of the steel industry on that high plane of efficiency and maximum output which it has reached during the past year. There has been afforded through the unexpected exigencies of this war a hitherto undreamed-of opportunity for governmental assistance in the upbuilding of a great merchant marine, as well as a striking illustration of the means by which American manufacturers can co-operate under government sanction and supervision for the supply of materials in enormous quantities. Idealized by the patriotism and loyalty which it has exemplified, we have had a close affiliation between the Government and the great industrial activities of the country, the value of which in solving the special problems of the present is of good augury for the service it may render in meeting the demands of the future.

National Chamber of Commerce Stimulating Recruiting of Shipyard Labor

Country-Wide System to Arouse United States to Importance of Shipbuilding and Immediate Necessity for More Men

IN its determination to turn out approximately 1,000,000 tons of ships between now and March 1, the Shipping Board and the Emergency Fleet Corporation will have the backing of the commercial leaders and business men in an elaborate plan of co-operation which will reach to every part of the country. Already, as a result of this effort, 35,000 shipworkers are wearing badges bearing the inscription, "War Service Ship Building, U. S. A." Also by means of patriotic posters and other methods of direct appeal enthusiasm for building ships to win the war has been stimulated.

In fact, through the National War Shipping Committee of the Chamber of Commerce of the United States every phase of the big problem now confronting the nation has been gone into, with the result that a great plea to shipworkers is now going forth through local chambers of commerce, trade bodies and organized meetings of citizens.

Quick Response from Commercial Organizations

No time has been lost by representative organizations joining the movement. Through the National Chamber War Shipping Committee, of which Edward A. Filene, of Boston, is chairman and N. Sumner Myrick, a well-known marine expert, vice-chairman, local committees have been formed by the following: Wilmington, Del., Chamber of Commerce, Newport News Chamber of Commerce, Chicago Association of Commerce, Tampa Board of Trade, Houston Chamber of Commerce, New Orleans Association of Commerce, New Orleans Board of Trade, Baltimore Merchants' and Manufacturers' Association, New York Merchants' Association, Newark Board of Trade, Seattle Chamber of Commerce and Commercial Club, Boston Chamber of Commerce, Philadelphia Chamber of Commerce, Charleston Chamber of Commerce,

* From a paper on "The Export Trade as Affected by the War," read before the American Iron and Steel Institute.

† President, United States Steel Products Company, New York.

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TO SHIPBUILDERS!
For the support of our soldiers in France the Government must have at once the ships you are building.
Without these ships the war can not be won.
OUR COUNTRY LOOKS TO YOU!
Every stroke of a hammer, every turn of a wheel may score as heavily as a shot fired from the trenches. Help our boys in France. With them win the war. Make the world safe for Democracy.

New Poster for Recruiting Shipyard Labor

Savannah Chamber of Commerce, and the Augusta Builders' Exchange.

These local committees are planning to hold meetings with the shipbuilders and have some member of the Shipping Board or other marine authority address the gathering and thus bring the builders into closer relation. Many of these committees have formed subcommittees on labor, housing and transportation, these measures being one of the most important phases of the general problem.

CALLING FORMER SHIPBUILDERS INTO SERVICE

The national committee, through its local committees, by way of co-operating with the Federal authorities, is making a survey of the labor resources in each district in an effort to secure the consent of employers to release, when needed, men formerly engaged in shipbuilding work.

There is no intention on the part of the committee to get labor away from one section to another. The object is to organize the resources in interior cities and towns so these places can be called upon to furnish men for shipyards when the need arises. In many interior centers there are those who have previously worked on ships. The committee through local organizations reaches such men. Volunteers who fill out a blank expressing their willingness to go to the coast and work in shipyards are given a shipworker's reserve button.

BADGE PRESENTATION TO REWARD FAITHFUL WORKERS

The badges are worn by workers in shipyards as an emblem of the patriotic service they are rendering the country in time of war. They can be worn only by those actually working on ships. As a reward for faithful service every worker who has fulfilled his obligations at the termination of the war will be given his badge outright in the expectation that he will preserve it as a souvenir of his contribution to victory.

Some 50,000 black and white labels have been distributed which bear the slogan: "Win the War. RUSH Material for Ships." They are used on the outside of railroad cars, pasted on packages, wagons and automobiles—in fact, everything used in the transportation of supplies.

Many hundred recruiting posters have been distributed throughout the country. They are used by the local committees and in campaigns for interesting workers in shipbuilding. At the suggestion of shipbuilders who felt they ought to have something in the yards to urge the men to do their utmost in the work, a new poster has just been issued and is now being posted in the various shipping centers. It is shown on this page.

REPRESENTATIVE MEN ON COMMITTEE

Besides Messrs. Filene and Myrick, above mentioned, the following are the members of the National Chamber War Shipping Committee co-operating with the Shipping Board: B. F. McLeod, of Charleston, S. C., president, Drake-Inness-Green Shoe Company; James W. Lee, of Newport News, American Bureau of Shipping; Charles Nagel, of St. Louis, formerly Secretary of Commerce and Labor; C. J. P. Mooney, director, Memphis *Commercial Appeal;* Crawford H. Ellis, of New Orleans, vice-president United Fruit Company; Harry L. Grant, of Chicago, Western Electric Company; J. C. Rohlfs, San Francisco, manager, Marine Department, Standard Oil Company; B. D. Caldwell, of New York City, president, Wells Fargo Company; Howard B. French, of Philadelphia, Samuel H. French & Co.; Charles E. Falconer, of Baltimore, president, the Falconer Company, and Judge Thomas Burke, of Seattle, Wash.

War Badges for Shipyard Workers

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Shipbuilders' Training Center Established

Intensive Training of Shipyard Instructors Begun at Newport News on November 15 by Emergency Fleet Corporation

IT is fully recognized that further increases of working forces in the shipyards must be met through the training of men. Workers from a wide range of occupations must be secured and given short, intensive training courses to fit them for the special lines of shipbuilding work in which men are needed.

Instruction and training in shipbuilding, it is believed, can be given only by skilled workers in shipbuilding occupations. It is generally recognized that these skilled workers are not usually capable of imparting their trade knowledge to others, and in order that large numbers may be trained in a short time, the instruction given to workers must be as effective as it is possible to make it.

In order to secure competent directors and instructors in the individual shipyards, the Industrial Service Department of the Emergency Fleet Corporation opened on November 15 at the works of the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., a school designated as the Instructor Training Center of the Emergency Fleet Corporation, where a series of short, intensive courses will be given in the method of giving instruction to groups of skilled shipyard workers, who will be selected by the shipyards themselves. This training center is in charge of a staff of industrial training specialists.

The first course at the new training center is being given to a group of about 200 men especially selected from the individual shipyards as the best qualified skilled workers to teach the beginners in the yard in which they are employed. Each shipyard has sent to the training center one or two prospective directors and a delegation of skilled workers, representing the trades in which trained men are most needed. Each prospective instructor is to be trained to teach only the trade in which he is thoroughly experienced. According to an agreement with the Emergency Fleet Corporation, the men detailed to receive instruction at the training center receive their regular wages from the yards which sent them, as well as the necessary expenses while they are taking the instructor training.

The staff of industrial training specialists in the service of the Emergency Fleet Corporation are putting these skilled workers in possession of effective methods of giving trained instruction to others. The instructor training experience is given to each group daily for a period of about six weeks. For one-half of each day the men receive instruction in how to teach others successfully. During the other half of the day the men are employed in actually instructing groups of workers in the Newport News shipyard under the supervision of the training staff.

When these men have completed their preparation as instructors they will return to their respective yards and set up training for the breaking in of new workers and for the advancing of employees from their present jobs to those requiring greater skill. Their places in the training center will immediately be taken by another group of men selected in the same manner to receive the same kind of training. These six-week periods of intensive training will be continued until a sufficient number of instructors are available in each yard to carry on effectively the instruction work required.

IF YOU CAN USE TOOLS
YOU ARE WANTED
Your country needs ships and men to build them — Armies, munitions and supplies are useless in this war without ships to transport them — Go to the nearest shipyard and offer your services — You can thus help to win the war and make the world safe for Democracy.

Recruiting Poster for Shipyard Workers

It is expected that as a result of this training one at least of the men sent from each shipyard will have shown himself to possess some qualifications of a fairly efficient director and that the other men will have had training to enable them successfully to serve as instructors and assist in the development of training schemes in their own yards. Each yard will then have a nucleus for a training department to which instructors may be added until the capacity is reached for giving emergency training to the number of workers required in the shipbuilding programme. The industrial training staff of the Emergency Fleet Corporation will assist the training department yards in the organization of their local training schemes.

Men selected as prospective directors of industrial training in shipyards must be natural leaders, have had experience in charge of men and show ability in directing groups. Preference will be given to men between the ages of twenty-five and forty having not less than five years' experience in shipyard work, and also who have had some technical education. The qualifications for prospective instructors are only slightly less stringent. The candidates must show evidence of possessing at least patience, dependability, regularity and clearness of expression.

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The Men Who Will Build the Ships: How the Department of Labor Will Get Them

Methods the Government Will Use to Secure 125,000 Shipyard Workers—Prompt Action and Loyalty Vital to Success

BY C. T. CLAYTON*

INCREASINGLY is it becoming evident that the result of the war in Europe may turn entirely upon the speed with which America's contribution in men, military supplies and food can be delivered on the other side. It is essential that the programme of the Shipping Board should be carried out, not only on schedule, but if possible earlier than schedule.

That programme now contemplates construction within the next sixteen months of more than seven hundred ships; some under construction for private account, commandeered by the Shipping Board, to be finished for the account of the Government. These commandeered vessels will be about one-half of the projected tonnage, which amounts to more than six million tons. The remainder of this tonnage has been contracted for, to be built by perhaps a hundred shipyards scattered along the Atlantic, Gulf and Pacific Coasts, with a few yards on the Great Lakes.

How Many Workers Are Needed?

How many workers are necessary to fully man these yards and carry out the construction programme according to schedule? How many would be necessary to hasten that schedule and if possible to secure earlier delivery of these contracted vessels? There are several estimates. Considering the contracts alone, without regard to the vessels commandeered and already under construction, the total amount to be expended is some $450,000,000 (£92,400,000). Labor costs in shipyard construction run roughly, about 70 percent of the contract price. Therefore, about $315,000,000 (£64,700,000) probably will be expended in the wages of labor.

Wages are higher to-day than at any time in the history of the United States; many men are being paid well in excess of $5 (1/0/10) a day. The average wage of common laborers in the shipyards is about 32 cents (1/4) an hour. But considering that the steadiest employed workers rarely make over 250 days in a year, with an average usually 30 days less than that, it is probable that the average shipyard wage does not exceed $1,000 (£205) annually even to-day. But at $1,000 (£205) per year per man employed in the shipyards a total labor wage bill of $315,000,000 (£64,700,000) indicates 315,000 men required to conduct the labor from raw material to the finished ship. As raw material represents about 20 percent of the cost of a vessel, some 252,000 men will be required to man the shipyards employed in building these contracted vessels, the remainder being engaged in the mines, forests and mills behind the shipyards. There are now about 130,000 men working in these yards upon these vessels, therefore the problem of manning the yards for a one-shift day means the obtaining of about 125,000 workers. These workers are not all skilled men, but approximately are 40 per cent skilled, 40 percent semi-skilled and the remainder unskilled; or 50,000 skilled, such as machinists, shipfitters, anglesmiths, etc.; 50,000 semi-skilled, such as riveters, bolters-up, reamers, etc., and 25,000 unskilled laborers and helpers.

For ten years the Department of Labor had been conducting and gradually developing the national labor employment service known as the United States Employment Service. It commenced as a humanitarian service for immigrants, called the Division of Information in the Bureau of Immigration. But it seemed just a little unfair that such a service should be conducted and financed by the Federal Government solely in the interest of foreign-born immigrants to lead them from the slums of the cities into profitable employment when native Americans, taxed to support the service, themselves received no benefit from it. Therefore, the United States Employment Service almost immediately was undertaken, building upon two words in the statute phraseology, "to furnish information to immigrants *and others*."

In the ten years since its institution in 1907, the United States Employment Service had expanded from a single office on Ellis Island to 94 offices scattered widely over 33 States of the Union and doing a business in finding jobs for workmen running up to 45,000 for the month of October, 1917. The service has a vast body of experience, the greatest possessed by any labor-finding machine in the United States, as it is indeed the only service crossing State lines. It has cared for the harvest needs of the country for the past four years, growing stronger and more efficient each season. It is the most economical organization for labor placement. Last year its cost of operation per person found employment was 65 cents (2,8½), compared with private employment agency charges, never less than $2 (8/4) for each job found, and often ten times that amount. This public agency, modest though it is, deserves a place in public affection beside our wonderful American Post Office Department.

The First Steps

At the beginning of hostilities the Shipping Board, a new organization of which the country then had hardly heard, announced its intention of constructing 1,000 vessels in aid of the Government's war programme. The plan was bold and well projected. The Department of Labor immediately offered the United States Employment Service to get the labor for the shipbuilding programme. Shortly thereafter, however, the Shipping Board became entangled in the unfortunate disputes which for several months very greatly delayed the shipbuilding programme.

Just before adjournment Congress gave the Department of Labor an appropriation of $250,000 (£51,250) for war emergency employment work. This sum is too small to take care of the tremendously varied war emergency labor needs of manufacturers doing construction work for the Government. The Department determined provisionally to expend the money to find the labor needed for shipbuilding. Its plan is very simple. In addition to the 94 offices it already conducts, and which will for the purpose of ship supply be managed as though part of the war emergency

* Special representative, United States Department of Labor, Washington, D. C.

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service—the Department has invited the 108 State and municipal public employment bureaus throughout the country to join in one national ship supply service. Telegrams are now pouring into the Department of Labor from these States agreeing to join in this service; most of them already have registered hearty acquiescence.

LABOR SUPPLY OFFICES

At ports nearest each shipyard the Department will establish terminal labor supply offices. Such offices are now in existence at several ports; at two other ports office space is ready and the men are being selected to man them; at the other points offices will shortly be established. Radiating from these offices as centers, calls will be sent out through the unified public employment system for the men needed as fast as the yards are ready to receive them. In many cases housing questions, conditions in the plants and other matters must be met before any concentrated campaign for ship labor can be undertaken.

The Department does not desire at this time to conduct a nation-wide advertising campaign for labor. One reason is that the Department has so far been able to find practically all the labor desired without great difficulty, and there is no use in conducting a drag-net campaign until the supply of labor is less available. Those familiar with manufacturers' problems realize that to increase the permanent force of the shipyards by 125,000 men within the space of some six or seven months means recruiting a vastly larger force than that. The "turn-over" in shipyards is to-day in excess of 300 percent; it may reach 400 percent; that would mean the entire replacement of a shipyard's force every three months.

REDUCING THE "TURN-OVER"

It is hoped that means to reduce this "turn-over" may be found and applied by the shipyards through improving conditions in the yards and obtaining habitable conditions in the nearby towns and villages. But under the best circumstances this "turn-over" will be likely to remain not lower than 150 percent; 150 percent "turn-over," complicating the general increase of 125,000 men, means about 382,000 men who must be found within the next six or seven months. Everything possibly adapted to cut down this drift in and out of the shipyards must be applied, and the United States Employment Service will do its share to reduce it.

EXAMINATION OF QUALIFICATIONS

Careful examination into the qualifications, experience and capability of the men before being sent to the yards is an element in employment service which seems never to have been fully recognized. In his very excellent study of the subject, Beveridge, the English scientist who established the great British labor exchange system, failed entirely to give this element any attention. Yet, obviously, it is no kindness to a man seeking employment to send him to a job he cannot hold, and the employment service which does not recognize this will itself lose the confidence of the employer and be of no value to the worker. Recognizing this, the United States Employment Service has been turning its attention to careful analysis of the men applying for work, with a view to placing them more accurately upon jobs which they can fill and hold and be satisfied in filling.

The Department of Labor is now completing the preparation of two books, one of which will carry definitions of every kind of occupation in shipyards—some 85 or 90 in all; the other, a little quiz book, which will enable the employment officers, as far as possible, to ascertain whether the applicants really understand the occupations for which they may apply. Accompanying these two books are the necessary report blanks to establish a genuine clearing-house service.

A second phase of employment service looks a little further ahead. It may become necessary as the supply of available and competent workers is reduced, to call upon men already employed in occupations adaptable for shipyard service, but upon production of less value to the safety of the country. This is what has been carelessly called "non-essential" industry. There are no non-essential industries, but there are grades of public value in industries. For the purpose of getting ready, in case such needs arise during the progress of the war, the Department of Labor has organized the United States Public Service Reserve, a separate bureau conducted under the Department.

PUBLIC SERVICE RESERVE

This Reserve conducts a most analytic classification of workers and professional men. Men now engaged in productive employment, but who are willing to consider changing their place of occupation to serve the nation better, are invited to join this organization. They fill out a blank, very carefully analyzing their capabilities, experience and aptitudes for service, and giving references to persons who know them. The facts stated in this application are registered in the files of the service. The kind of employment they are engaged in is carefully noted. When the time comes that labor cannot be found except by calling upon men in less essential occupations, the files of the United States Public Service Reserve will be available for the employment service to draw upon as the second line of defense.

The more general these files are of such workers the better for the general interests of business men and manufacturers; because if most, or all, men in mechanical occupations at least, are represented in these files it will be entirely practicable to so allocate the calls in percentages to be asked to go from any particular industry that that industry shall not be hurt or greatly hindered. If some process such as this were not thoroughly worked out and scientifically applied, and if instead of such a process the voluntary system were indiscriminately brought to bear upon any locality in which men could be obtained, we should find one industry untouched and flourishing while another industry would be entirely crippled or destroyed by the taking of men from it to the shipyards or to some other industry needing workers.

It is with a view to protecting the interests of all concerned, so far as possible, that the Department of Labor has projected and is rapidly establishing the United States Public Service Reserve and expanding the United States Employment Service as a most essential war service to the nation's workers and to the nation's business.

AGENCIES ENLISTED

In projecting these plans, the Department of Labor is enlisting every agency. It is in close touch with the great Chamber of Commerce of the United States and with its special shipbuilding supply committee. The officers of this committee have given much patriotic service and counsel to the Department. They have come at its call on numerous occasions and have pledged their services, which will be of the most extreme value in setting up additional employment offices in many cities in the United States not now having any public employment office.

(*Concluded on page* 550.)

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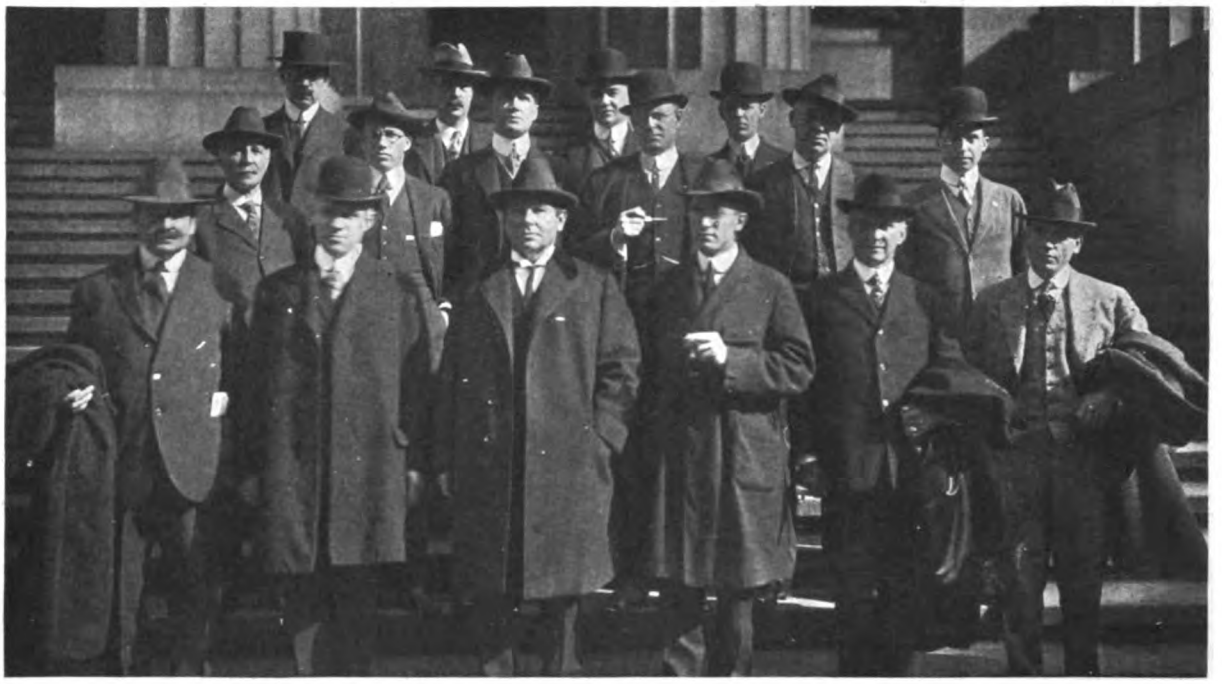

Men Who Are Recruiting 10,000 Officers for the New Merchant Marine

Front Row (left to right)—Prof. Carl C. Thomas, Johns-Hopkins University, Baltimore; Eugene E. O'Donnell, supervising inspector, 5th district, Steamboat-Inspection Service; Henry Howard, director of recruiting, U. S. Shipping Board; Capt. Irving L. Evans, Cleveland; William J. Grambs, Seattle; Farnham P. Griffiths, San Francisco.

Second Row—Dean Alfred E. Burton, Massachusetts Institute of Technology; W. Marriott Welch, assistant to director of recruiting; Henry G. Vaughan, Sea Service Bureau; Edward C. Hovey, chief, Sea Service Bureau; Edward F. Flynn, assistant to director of recruiting; G. Maurice Congdon, Providence.

Back Row—Winfield M. Thompson, field agent, Recruiting Service; Prof. Edward F. Miller, marine engineering department, Massachusetts Institute of Technology; James J. Raferty, president, and George H. Willey, business manager, Marine Engineers' Beneficial Association.

Training Officers for the Merchant Marine

Conference of Shipping Board Recruiting Service Officials Shows Genuine Revival of Interest in the Merchant Marine

ON October 26 and 27 a conference of officials of the United States Shipping Board Recruiting Service was held at the Chamber of Commerce, Boston, for the purpose of perfecting details connected with the work of training officers for the new ships of the merchant marine.

The Recruiting Service, which began its work in a small way in May last, has grown to be an important arm of the Shipping Board's varied activities. At present it is engaged in training deck officers and marine engineers at twenty-seven free navigation schools and eight free engineering schools. Not less than 12,800 deck and engineer officers will be needed for the 1,600 ships called for under the Shipping Board's present construction plans. A majority of these ships will take the water in 1918.

It is expected that the experienced, seasoned men now in the merchant service will be sufficient to take the senior posts on the new ships. The Shipping Board's schools are therefore devoted to training a sufficient number to fill out the complements thus started. The service is prepared to train not less than 10,000 men for this purpose. Only men qualified to meet the requirements of the Steamboat Inspection Service as to experience are accepted for training, except in the case of specially qualified men who will take special sea service after graduating from a school and before coming up for their licenses to secure the amount of experience required by the inspectors. In no case are inexperienced men taken for training.

At present not less than 350 students are being trained in each six-week term of the navigation schools, and not less than 275 students in each term of one month in the engineering schools.

The Recruiting Service of the Shipping Board is conducted largely by volunteers, men of business training with an interest in seafaring matters, who are giving their time to the Government. Henry Howard, of Boston, who originated the training plan and was appointed Director of Recruiting for the Shipping Board on May 29, is the head of the Merrimac Chemical Company and a member of the Council of National Defense Acid Committee. To aid him, Mr. Howard has a staff of volunteer workers to look after recruiting and the schools in various sections of the country, as follows:

For New England, G. Maurice Congdon, a steel merchant of Providence; for Pennsylvania, New York, New Jersey, Delaware and Virginia, Prof. C. C. Thomas, of Johns Hopkins University, Baltimore; for North and South Carolina, Georgia and Florida, Hardy Croom, manager of a transportation company at Jacksonville; for the Gulf Coast, Ernest Lee Jahncke, of New Orleans, a contractor and shipbuilder; for California, Farnham P. Griffiths, of San Francisco, an admiralty lawyer; for Oregon and Washington, W. H. Grambs, manager of a power company at Seattle; and for the Great Lakes, Captain Irving L. Evans, an admiralty lawyer of Cleveland. Cap-

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tain Evans holds a master's license, unlimited, ocean-going. Mr. Grambs is a graduate of the Naval Academy. Mr. Jahncke is commodore of the Southern Yacht Club.

Mr. Howard also has a volunteer executive assistant, W. Marriott Welch, a Boston lawyer.

While the Boston conference was devoted chiefly to the details of working plans for enrolling and training men and placing them in sea service afterward, consideration was given to several matters of general policy. The substance of the reports of the section chiefs was that there is a genuine revival of interest in the merchant marine all over the country—especially on the Pacific Coast.

Licensed Steamship Officers to Aid Shipping Board Recruiting Service

AN advisory committee of licensed officers in the Merchant Marine, to work in conjunction with the United States Shipping Board Recruiting Service in securing officers and crews for the new ships to be added to the country's cargo fleets, was formed November 6 at a conference between representatives of the various officers' associations and officials of the Shipping Board Recruiting Service at the Boston Chamber of Commerce.

The committee, of which Henry Howard, director of recruiting for the Shipping Board, will be chairman, will include a representative of each of the licensed officers' associations on the Atlantic and Pacific coasts and the Great Lakes. It will meet the Tuesday before the first Wednesday in each month, at Boston, to discuss problems having to do with the manning of Uncle Sam's new merchant fleet.

It is expected that the close co-operation thus secured between representatives of the officers' associations and the Government will have a beneficial effect in the securing of representative American complements for the new ships.

Discussions at the conference showed a concert of opinion on the problems to be handled, which include regulation of the supply of licensed officers to meet varying demands of the constantly growing service, exemption of trained men in the merchant marine from military duty, and the building up of an all-American merchant marine.

Delegates to the Conference on Officering Emergency Fleet Cargo Vessels Held at Boston, November 6, 1917

Front Row (left to right)—Prof. Carl C. Thomas, Johns-Capt. Robert M. Lavender, National Trustee, American Association of Masters, Mates and Pilots; Henry Howard, director of recruiting, United States Shipping Board; William S. Brown, National President, Marine Engineers' Beneficial Association; Capt. Arthur N. McGray, secretary-treasurer, Neptune Association, also representing the Masters, Mates and Pilots of the Pacific Coast.

Middle Row—Capt. Ulster Davis, National Trustee, American Association of Masters, Mates and Pilots; Capt. Luther B. Dow, business manager, American Steamship Licensed Officers' Association, Inc.; George W. Willey, business manager, Marine Engineers' Beneficial Association, No. 59, of Boston; James J. Raferty, Jr., president, Marine Engineers' Beneficial Association, No. 59, of Boston; Capt. Irving Sparks, Boston agent, Neptune Association.

Back Row—Winfield M. Thompson, field agent, U. S. Shipping Board Recruiting Service; Edward Clarence Hovey, Jr., chief, Sea Service Bureau; Bert L. Todd, secretary, Ocean Association of Marine Engineers; Thomas A. King, chairman Board of Directors, Ocean Association of Marine Engineers; Henry G. Vaughan, Sea Service Bureau; Edward F. Flynn, assistant to director of recruiting, U. S. Shipping Board.

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The officers' associations were represented at the conference by Captain Arthur N. McGray, secretary of the Neptune Association of New York, who also represented, by request, the Masters', Mates' and Pilots' Association of the Pacific Coast; Captain Luther B. Dow, of New York, business manager of the American Steamship Licensed Officers' Association; William S. Brown, of Buffalo, national president of the Marine Engineers' Beneficial Association; James J. Raftery, of Boston, president, and George H. Willey, business manager, of the local branch of that association; Captain Irving Sparks, Boston agent of the Neptune Association; Captain Robert M. Lavender, of Boston, national trustee, American Association of Masters and Pilots; Captain Ulster Davis, of Albany, holding a similar position; Bert L. Todd, secretary, and Thomas A. King, of New York, chairman of the directors of the Ocean Association of Marine Engineers, N. Y.

The Shipping Board Recruiting Service was represented by Director Howard, Edward Clarence Hovey, Jr., and Henry G. Vaughan, of the Sea Service Bureau; Edward F. Flynn, assistant to director; Winfield M. Thompson, field agent, and Captain Eugene E. O'Donnell, supervising inspector, Fifth District, U. S. Steamboat-Inspection Service.

The War's Effect on Merchant Shipbuilding*

Enormous Tonnage Required by the Government—Increased Shipbuilding Facilities—Types of Ships—Standardization—Labor Problems

BY HOMER L. FERGUSON †

THERE have been two schools of thought regarding the proper method of meeting the German submarine campaign. One school has held that only by the production of the maximum number of ships in the shortest space of time until the production of new vessels should more than equal the destruction of vessels in being would the question be answered. The other school has held that there were vessels in plenty to feed England and to carry our troops to France and to feed them, and that the proper method to meet this menace was to build a large number of submarine chasers, destroyers and other vessels of war to go after the submarine itself.

The exponent in an official way of the theory of building the maximum number of ships is, of course, the United States Shipping Board, with the Emergency Fleet Corporation as the largest individual owner and builder of merchant ships anywhere, either at this time or at any other time, in the history of the world. All of the shipbuilders have had their new ships commandeered by the Shipping Board, and these ships are now being pushed to completion under the direction of the Shipping Board. In addition to the ships under construction at the time the Shipping Board took over all these vessels on August 3 last, the Shipping Board has placed contracts for 200 to 300 additional steel ships and for about 200 wooden and composite ships. The English have built ships at a very rapid rate during the past six months, but prior to that time their capacity had fallen off woefully. The figures of British shipbuilders are that in normal years their capacity in tons was about two million. In 1915 they built only 700,000 tons. In 1916 only 550,000 tons. In the first six months of 1917 they built 500,000, and by the end of 1917 they will have built during this year almost 2,000,000 tons, or practically their normal tonnage.

CAPACITY OF AMERICAN SHIPYARDS

In comparison, it is interesting to look at our record, which is mostly in the future. The largest tonnage ever built by us in any year prior to the present year was in 1908, when we built 615,000 tons. In 1917, or at the end of the fiscal year of 1916-17, on July 1, the total tonnage turned out in merchant ships in this country was close to 800,000 tons. Of course we expect that that will be bettered very much, and the production, except for labor difficulties, would have been very much greater than that; but it is a far cry from 800,000 or 1,000,000 tons of ships a year to a prospective 2,500,000 to 5,000,000 tons of ships a year, and especially when we consider that the best the first shipbuilding country of the world ever did in any one year was only 3,000,000 tons.

Now as to the methods of turning out such an enormous tonnage in a short time. If the war does nothing else for shipbuilding, it will at least demonstrate that the individual tastes of individual owners need not be met in every instance. Hitherto ships have not been built alike for the reason that ships were built by units and tens instead of by thousands. But with a single ownership, like the Emergency Fleet Corporation, it becomes possible for the owner to specify that all ships shall be alike, and thus we have standard ships!

There is an idea extant that if a ship is called "fabricated" or "standardized" it becomes rather easy to build. It does become easier to build, but it is not any easier to drive a rivet in a fabricated ship than in a common ship, and the 7,500-ton fabricated ship will have about 650,000 rivets and some riveters must do a considerable amount of work to drive those rivets in that ship the same as in any other ship. The most onerous work in building a ship is in the driving of the rivets; and if any concern is going to build one ship a week, it must drive 650,000 rivets a week. When we consider that the best rivet drive is by the Union Iron Works, where they drive 250,000 rivets a week, and the next best by the three largest shipyards on this coast is about 200,000 rivets each per week, the problem of driving 650,000 rivets a week assumes a rather difficult aspect to the casual observer. Still, we all hope it will be done, but if it is done it means the importation of an enormous number of new workers into the industry.

THE FABRICATED SHIP

The fabricated ship has the center of the stage at the

* Extracts from address delivered at a Joint Meeting of the Engineers' Club of Philadelphia and the Philadelphia Section American Society of Mechanical Engineers at Witherspoon Hall, Philadelphia, October 16, 1917. Reprinted from the *Journal* of the Engineers' Club of Philadelphia and Affiliated Societies.

† President of the Newport News Shipbuilding and Dry Dock Company.

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present time. In England a standardized ship was adopted which is very much like a fabricated ship, and they are being turned out at a rapid rate. The fabricated ship, like the English standard ship, has the disadvantage of low speed, and at the same time it has the advantage of a large carrying capacity. The records of submarine sinkings, such as have been gathered, indicate that speed is probably the safest defense against the submarine. The number of very slow ships sunk is very great in proportion to the number attacked. Probably 90 percent of the slow ships are sunk when attacked by a submarine. As the speed becomes greater the immunity of the ship from torpedo attack becomes greater—not only because she presents a more difficult target, but also because the vessel may run away from the submarine in darkness or in daylight if she has a greater speed than the submarine has on the surface, and also because the vessel may be maneuvered much more quickly. One of the most gratifying things about submarine warfare is that the torpedoes are not making the speed as in the early days of the war. The speed of the torpedo has undoubtedly become much decreased. Just why we do not know, although it is probably due to the absence of tungsten and manganese and some other ingredients now so difficult to obtain in Germany. Vessels of 16 or 17 knots have actually dodged the torpedoes.

The vessel of 16 or 17 knots is also needed to carry soldiers. We are shipping all our soldiers to Europe in vessels of 14 knots or over because it is thought to be too hazardous to ship them in slower vessels. We have at the present time in this country enough vessels in commission to ship soldiers to Europe at the rate of not more than 1,000,000 a year. That includes all vessels of 14 knots or over. But, by building a large ship as well as a speedy ship an additional factor of safety is obtained, which may be illustrated by stating that a torpedo will blow just as big a hole in a little ship as in a big ship. When a small, short ship has a large hole in it a relatively larger proportion of its length is open to the sea. When a similar hole is blown into a long ship a very much smaller proportion of that vessel is open to the sea. So that it is perfectly possible to design, and practical, indeed, to design, a ship of 500 or 600 feet long, so subdivided that it will take two and probably three torpedoes of the German variety and still stay afloat. The design, however, must be of such character that when the compartments are flooded the ship will still remain upright. The ordinary passenger ship is modeled with a small metacentric height, and three-fourths of them, when bilged or torpedoed, will probably turn over before sinking.

A great deal of talk was heard years ago, when the *Titanic* went down, about making ships safe. The *Titanic* was probably the safest ship that ever crossed the ocean, with the exception of the *Olympic*. The *Empress of Ireland*, the *Lusitania* and the whole host of passenger ships of which we have any record, have turned over as they went down, and they probably righted after they went down. So that in designing a ship that will be safe against submarine attack not only must the question of subdivision be taken care of so as to limit the length of the vessel that may be damaged by a torpedo, but also that the vessel when torpedoed will remain upright and be able to get into port. A number of vessels have been torpedoed and have been towed into port and repaired on the other side, even after the crews had deserted them.

The larger type of ship which will probably be built before the war is over by a number of concerns in a position to undertake this work will be designed with a high speed for troop transport, with a close subdivision to make the ship safe, and with a large amount of stability so that the vessel will also be safe against turning over.

Types of Vessels Developed

The war so far has developed, or called attention to, three distinct types of vessels: The standardized or fabricated ship which both England and the United States have adopted, the large troop transport which has been described, and, in addition, a submarine chaser.

In addition to these three types of ships brought out by the war, there has been a very definite attempt to rejuvenate what some of us have considered a dead industry. We have a few of the older wooden shipbuilders left, but the building of a wooden vessel, to my mind, is so much more difficult than the building of a steel vessel and requires so much higher skill than does the building of a steel vessel, that I wonder how they can ever expect to build them.

Wooden Ships Ineffectual

I do not believe that a 288-foot wooden ship built in a lumber yard, either south, west or north, and necessarily by men who are not expert ship carpenters, will ever relieve any great distress on the other side of the water, caused by lack of fuel or food. On the other hand, these vessels may be used in our own trade at home. My chief regret is that they are not made shorter, because when such ships are over 200 feet long it is rather difficult to hold the ends up. If we get more vessels through building wooden ships, let us build them, but it is unfortunate that the type was settled before many professional wooden shipbuilders were on the job. The wooden shipbuilders, of course, have taken a good many men from the steel shipyards and have lessened production to just that extent; but, on the other hand, they will add a very considerable tonnage, now that practically all our large coastwise ships are either going abroad or are in way of being commandeered for foreign service, so that the wooden ship will serve a useful purpose.

Standardization

The standard ship probably offers the best opportunity for a large increase in our tonnage. The standard ship has been built on the Great Lakes for years. Shipbuilding there has become largely a manufacturing operation, for the reason that the ships themselves simply form a part of the manufacturer's business of carrying iron ore from Lake Superior down through the canal to the eastern points, where it is shipped to the steel furnaces. The loading and unloading of the ore permitted the standardization of docks, hatches and so on, and the method of construction became standardized because the work which the ship did was standardized. Many ask why we do not build ships just as they do on the Lakes, and the answer is that we do not do the same work that they do. On the coast, with the coal trade, there has been some effort toward standardization. With the standardized ship the main benefit is not in the hull of the vessel, or in the fabrication of the vessel in the steel mill. The main benefit is that the machinery and the outfit, the winches, the pumps, the steering gear, the engines and boilers and all the thousand and one things that go into the ship are standardized and may be produced in large quantities at some point other than the yard of the builder. The standardization of the fittings of a vessel are more important to my mind than the standardization of the hull. The amount of money saved in the latter will be the money to build the templets, patterns, etc., amounting to not more than 12½ to 15 percent of the

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labor cost of the hull. We are told, too, that all the riveting will be done at the steel mills. It probably will not, and if 20 percent is done it will be more than I think will be done unless the railroads will carry pieces of steel as large as this auditorium.

STANDARDIZED SHIP FITTINGS

Shipyards have naturally tried to standardize within their own practice the fittings that go on the various ships they build, and a great step is being made in that direction by one of the largest corporations in the country. The Bethlehem Company owns so many shipyards that they are in a position to standardize as between their various yards, with the result that there will be considerable saving in cost and in time in the production of all the things that go into a ship. But in building the standardized ship, or in building any other ship, the real problem is not the problem of equipment; it is not the problem of money even; it is not, except in part, the problem of location, but it is the problem of men. A very simple lesson in arithmetic will indicate that if 100,000 rivets are to be driven in one day and any one gang of riveters will drive 300, then it will take so many men and boys and helpers to get that drive.

SHIPYARD LABOR THE REAL PROBLEM

It is quite desirable to get back to our arithmetic again when we have built so many ambitious high hopes of what we expect to do. For instance, on the Delaware and on the Chesapeake, which we on the Chesapeake are pleased to consider the two largest shipbuilding communities in the United States, there are at present about 33,000 men employed in the shipyards. There could be employed to advantage in these same yards at this time a total of 48,000 men, and within the next six months, or the next nine months at the latest, these same yards, barring the fabricated shipyards, could employ to advantage a total of 60,000 men. So the problem becomes arithmetical again. You have 32,000 men working. To get the maximum production out of the shipyards already in existence you will need to use 60,000 men. Where are the 28,000 extra trained shipbuilders to come from? Add to that the fabricated shipyards, which, on the Delaware will probably require 20,000 men, and in the vicinity of New York an extra 10,000 and we have in this immediate district need for approximately 60,000 new mechanics in the shipbuilding business.

150,000 SHIPYARD MECHANICS NEEDED

According to Admiral Capps, there will be needed in the whole United States in shipbuilding within the next six months an additional 150,000 men. Now, consider for a minute where these men must come from or how we are to get them. In the first place, most shipbuilding men or mechanics require both skill and experience. We can give them the experience fairly quickly, but we have not time to give them the skill. In other words, it is necessary that men be recruited from industries where they do work similar to the work of shipbuilding in order that they may become quickly adapted to the work of shipbuilding.

The problem of oversea transportation absolutely has to be met before we can get into the war effectively, and the problem of sea transportation is probably the most difficult of all problems we have to face. Therefore, the men should be furnished for the solution of this problem, no matter what industry they are taken out of. The problem of building these ships becomes the most important single problem that confronts us at the present time.

CONTROL OF SHIPYARD LABOR

I do not say that I favor the conscription of laboring men, but I do say this—that sooner or later the United States will tell all men who are essential in any industry or any occupation in the prosecution of the war that *this* is their job and they are to stay by it until the war is over. It is perfectly ridiculous that our men who are already in Europe and those who are going there now should for a minute suffer on account of some difficulties that arise between employers and employees in the great shipyards of this country. Not only should the man who pounds iron and drives rivets be told that he shall be kept on his job, but also every employee in the company, from the president down to the office boy, is to do the same thing, and he is not to seek or obtain other employment, except for good reason given the Government authorities. If we are in the war to win, no one should be timid about telling the laboring man or the unions or anybody representing them just what part they have got to play along with the part that other people should also play.

It is held by the National Council of Defense, and by a number of exalted bodies that the *status quo* as between employer and employee should remain the same during this war. Of course, it should remain the same, and we all know that it is not remaining the same, and we all know that the labor leaders as a rule are unable to control the men. I do not see why of all the men who have been passed into the National Army we should not have in as essential an industry as shipbuilding those of them who are mechanics on conditions set by the Government and on pay to be approved by the Government, to work in these shipyards until the war is over, or until they should perchance prefer to go to the front instead of staying in the shipyards.

I understand that in Philadelphia it is very difficult to have any of the shipyard employees excused from military service. Of course they have their own rules to go by in Washington, and we must all abide by them, but it is rather unfortunate that they should be differently interpreted in different parts of the country and it seems to me most unfortunate that the shipbuilders have been allowed to go to the front. The experience of England was that they had to take out of the trenches not only the shipyard workers but the ammunition workers and send them back to the factories again. It is a pity that we could not profit by that. That would be a solution that would help very much with this laboring man difficulty.

FIXING WAGES

The demand is largely in excess of the supply of men. The sympathy of the Government is with the men. At our Navy Yard under the law we pay the going rate in that vicinity and arbitrarily fix the rate at a larger rate than the going rate in the vicinity which we have to meet, and we are told in case of difficulty we must keep going, so it is only a question that can be worked out by the Government's representatives and the shipyard employers together.

I would be perfectly willing to see all the shipbuilders go down to the Navy Department and Shipping Board and say, "We will agree with you on these conditions and stand by them and will shut up our shop before we pay any more." Of course it can be said that a man who works is entitled to any wage he can get. Perhaps he is, but he is not entitled to stop working now, and he is not entitled to say that any other man shall not serve an apprenticeship now. He is not entitled to say that a helper shall not do a mechanic's work if he can do it. How perfectly ridiculous when a million and a half of

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the best young men that we have in the whole United States are serving an apprenticeship in the war, leaving their homes and going out to learn the art of soldiering in a very short time, and quite as difficult work to learn as riveting. What a ridiculous thing to say at a time like this that a man cannot get a job unless he has served his time at the trade, and tie the hands of the United States in this great war, which it must win if you and I are going to keep on being proud of living in the United States.

I was shown to-day in the case of a number of workers that the money which they could earn in a day was limited by the organization to which they belonged, and that if they earned that much money at two or three o'clock in the afternoon they would work no more, notwithstanding the fact that the management wanted them to do it. When will people ever learn that production by the use of labor-saving machinery to get a large production per man is all that gives us more than we ever would have otherwise or than we ever would have had before the days of large production? And yet they have limited production with the idea of giving more jobs to more men in time of war when we have not got enough men and have about three jobs for one man!

HOUSING SHIPYARD WORKMEN

The condition of laboring men who are gradually coming in from the West to all the seaboard towns is a very difficult one, and a great deal of the basis of discontent is a lack of suitable housing conditions. That is ordinarily taken care of in the towns and cities by real estate people and those who build for investment, but at the present time that method is wholly inadequate, and this question will have to be considered along with the same programme as that for our army which is being installed in cantonments all over the United States. The Government is waking up to this in the case of some recent contracts let for destroyers. The Government itself will finance the building of barracks or temporary hotels for the men, so that several hundred can be housed at or near the shipyards where the work is to be done. One of the biggest problems England had was the formation of new communities and the building of whole towns. In some cases, they were almost ten miles square, and in them were provided not only ordinary houses and living accommodations, but public parks, playgrounds, theaters and everything needed in a modern town.

The shipbuilding problem comes back to the question of men and willing men—willing to do work under conditions which their own Government and our representatives say are fair and honorable both to the Government and to the men, and I say that if they will not work under conditions such as the Government specifies and at the rates of pay which the Government calls fair, then they should either be made to, or made to let alone the men who are willing to do so.

I cannot imagine the United States letting stand in its way any band of men whatever when the national honor and national life, in fact, depends on our winning this war, and when we are sending forth our young men and boys by the thousands to France.

TREAT EVERYBODY ALIKE

As a business man, I do not know of any man in the shipbuilding business who would care, and I, myself, do not care how much of my income the Government takes, as long as it treats everybody else the same, and as long as the business is left with enough money to carry on its operations and pay a most moderate return to the owner and be able to serve the Government in the best way. I do not care how much of the profit of the business they take, and I will go further than that. If it becomes necessary for the raising of money, a conscription of capital would not hurt my feelings at all. We are willing, if necessary, to have the plants commandeered by the Government, under the terms of the United States and under conditions which they see fit to impose but we do insist that managers, foremen, superintendents and men shall all be treated alike.

Those of us who are building ships or destroyers have a very difficult time in securing priority in getting material. We have received from the Navy Department and from the War Department and from the Shipping Board orders to proceed with the utmost vigor and despatch to do their work, each in the same tone of voice, each with equal authority, all vested in these various departments by Acts of Congress, so that actually what has happened is that the president of our Company has had to settle the question of priority himself—an entirely improper function for him. The question of priority and preference is now the biggest industrial question there is, for the very simple reason that the total production of the United States has been over-absorbed by these war activities.

PRIORITY IN GETTING MATERIAL

With the prices settled, the only important thing is, who gets his first, who second and who third. We have in the War Department six bureaus buying frequently in competition with each other. We have in the Navy Department five or six bureaus buying, or recommending to buy, not in competition with each other very much, but somewhat. In the Shipping Board we have a tremendous amount of buying going along more or less in competition with the War Department and the Navy Department. The Government simply wants to get the material in such quantities as it can, but it is simply impossible to satisfy all these Bureaus and Departments. What is the answer?

MUNITIONS MINISTER NEEDED

The answer that has been found in Great Britain in the very first months of the war was to divorce the question of business, buying and price fixing from the naval and military activities of the country. A munitions minister was appointed; just the kind that we need. The Chamber of Commerce of the United States recommended that a Board be appointed. I am a director in that Chamber, but I think a minister should be appointed, because you want a *man* who will coördinate the interests of the country. What have we in our country? We have great army cantonments. We have great army and navy orders from the Government and are competing day after day; we do not know who is first, second or third. I am sure that the Secretary of the Navy and the Secretary of War have both plenty to do to run the operations of their great departments without working a large part of the time with the question of buying, and whether they are going to get this first, second or third. We have a Priority Committee, but they cannot settle it, but only recommend it. Actually, the best buying is done by the official who is the most zealous, so that we run great risk, if that keeps on, of having our soldiers on the other side with plenty of guns and maybe gunpowder, but not enough baked beans or peas or something that they need. It must be done in some way so as to least upset the country.

Another reason that business should go on as well as possible because we have to earn some money somehow in order to meet the war taxes, and there is no need

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of disrupting it unnecessarily in buying in various ways. That has had a bad effect on the shipbuilding business.

FORGING SITUATION A WEAK POINT

The weakest point in the shipbuilding business is the forging situation, in my judgment. There are not enough forges in the United States to turn out all the forgings required for the shipbuilding. The great Bethlehem Company, Midvale, and the Allis-Chalmers are practically the only large ones we have, whereas Great Britain has twelve or fifteen very respectable forging concerns. It is absolutely necessary that someone determine whether this or that or the other kind of forgings shall be first; otherwise a lot of us are apt to end up with hulls but no machinery in them. But we would very much appreciate it if we could go to Washington and say to someone that this is the most important, and that is the next, and that is the next. Instead of that, we appeal from one department to another and frequently end up with nothing.

I am mentioning this to you because it is very much in my heart and mind; I see it in Washington every time I go there, and I hope very much that next winter when the question comes up in Congress they will see fit to centralize the buying of war materials instead of scattering the work among the Navy Department and the War Department and the Shipping Board.

TRAINING SHIPYARD WORKERS

We all know that it is a joy to have a few good mechanics and give them a job and forget about it, but we have to get away from that and to teach new people, which may, fortunately, be done with ships of standard make and duplicate makes. The biggest problem that the employment managers have at the present time is to get hold of the best material possible, house it as decently as we can, and teach it shipbuilding as quickly as possible. The problem almost dazes one to contemplate. It can only be solved by bringing in enormous quantities of new men, and which must be done without any hindrance. The leaders of the unions have stated that they would allow this to be done. We have to do it, and no matter what else happens we must insist upon the right to break in any number of new men in the business. The Shipping Board will back it up, and I am sure that sooner or later the Administration itself will insist upon that being done on such a comprehensive scale as to make it possible for the United States to carry out its great shipbuilding programme, which *must* be carried out.

S. S. SYLVAN ARROW.—The third ship of a contract for four that was placed with the New York Shipbuilding Corporation, Camden, N. J., two years ago by the Standard Transportation Company of New Jersey, was launched on October 16, ninety-two percent complete, her keel having been laid on March 22. If it were not for the fact that the ship has been commandeered by the Government, and extra work was required by the Shipping Board, the vessel would have been able to leave the yard within about three weeks after the launching. The vessel is a tanker of the shelter deck type, built on the Isherwood system of longitudinal framing, with the boilers and machinery aft, as is common for oil tank steamers, and the cargo pump room amidships. The hull is 485 feet overall, 468 feet 6 inches between perpendiculars, 62 feet 6 inches molded beam, and 39 feet 6 inches molded depth to shelter deck. The draft on a summer freeboard is 26 feet 6 inches. There are 20 main tanks with a combined capacity of 3,500,000 U. S. gallons and 10 summer tanks with a capacity of 450,000 U. S. gallons. The fuel bunkers hold 720 tons of oil. Propulsion is by a four-cylinder, quadruple expansion, surface-condensing engine with cylinders 24 inches, 35 inches, 51 inches and 75 inches diameter, with a stroke of 51 inches designed to develop 3,200 indicated horsepower at 82 revolutions per minute. Steam is supplied at a working pressure of 220 pounds per square inch by three single-ended Scotch boilers fitted for both coal and oil burning.

Reinforced Concrete Motorship Launched Bottom Upwards

THE series of photographs shown on the opposite page illustrates the launching of the 200-ton reinforced concrete motorship *Beton* 1 at the yards of the Porgrunds Cement Construction Company, Porgrunds, Norway, in August, 1917. As shown by the illustrations, the vessel was put into the water with the keel uppermost, and after a period of fifteen to twenty minutes slowly righted herself.

This novel method of launching was adopted, not by reason of any inherent advantage in the launching operation itself, but on account of the methods used in constructing the boat. In the first place, an inner hull of wood was constructed with the keel uppermost, which served as a mold around which the concrete was poured for forming the hull. After the mold was made, the reinforcement and the cement were formed around this, and, when the construction was complete, the entire structure, including the mold, was launched into the water in the position in which it was built.

The inner mold was divided into water compartments, a center compartment being open to the water. The air in this and in side compartments next to the bottom of the vessel was gradually exhausted through vent pipes after the vessel was in the water. Side compartments immediately under the deck of the vessel, however, remained filled with air, so that as the part of the mold open to the water was gradually filled with water the center of buoyancy was lowered below the center of gravity and a moment exerted righting the craft to her normal position in the water. The flooded compartments were then pumped out and the inner wooden hull removed to be used again as a mold for the construction of another vessel.

After launching, the vessel was equipped with a 70-horsepower Skandia motor.

New Navy Specification for Steel Castings

New specifications governing the manufacture of steel castings have recently been issued by the United States Navy Department. They are dated May 1, 1917, and are designated as 49 Std, superseding those issued June 1, 1916. The chemical and physical properties demanded by these specifications are as follows:

PHYSICAL REQUIREMENTS

Grade	Percentage Chemical Composition (not over) P.	S.	Minimum Tensile Strength, Lb. per Sq. In.	Minimum Yield Point Lb. per Sq. In.	Minimum Elongation Percent in 2 In.	Minimum Reduction of Area, Percent	Bending Test † (not less than)
F*	0.05	0.05	85,000	53,000	22	35	120 deg.
A	0.05	0.05	80,000	‡	17	20	90 deg.
D	0.05	0.05	70,000	‡	22	30	120 deg.
B	0.06	0.05	60,000	‡	22	30	120 deg.
C	0.06	0.07	.....	.....	..	..	.....

* Grade F castings may contain nickel or other alloying metals.
† Cold bend about an inner diameter of 1 inch.
‡ Forty-five percent of tensile strength obtained.

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NOVEL LAUNCHING OF REINFORCED CONCRETE SHIP

By Porgrunds Cement Construction Company, Porgrunds, Norway

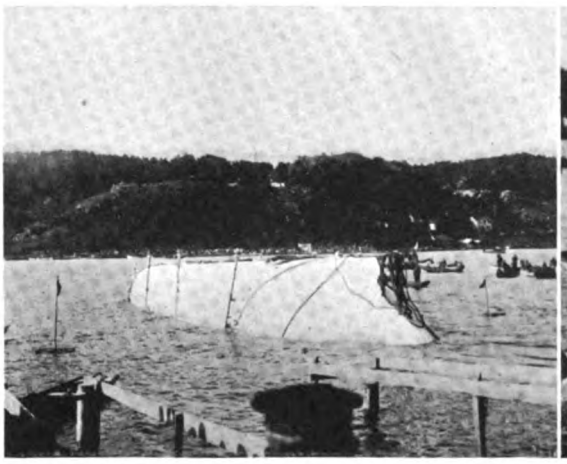

Fig. 1.—Concrete Ship—Bottom Up—Just After Launching

Fig. 2.—Concrete Ship Beginning to Heel Over

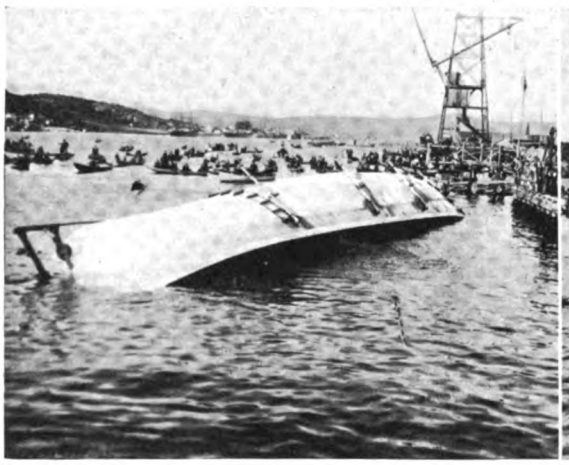

Fig. 3.—Heeling Over

Fig. 4.—About to Right Itself

Fig. 5.—On an Even Keel

Fig. 6.—Ready for Pumping Out

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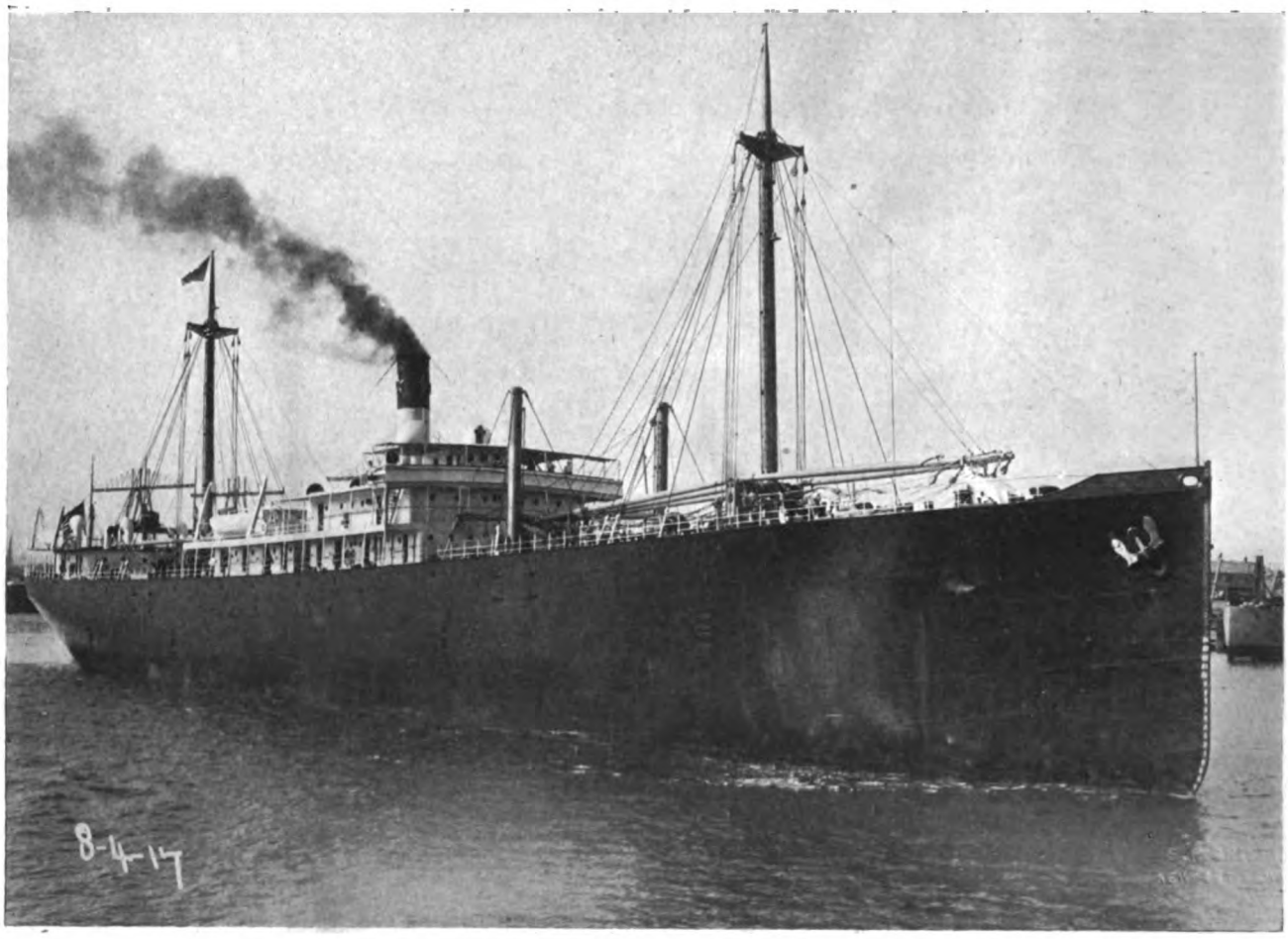

Fig. 1.—S. S. *El Capitan*

New Southern Pacific Freighters

Single-Screw Vessels Built at Newport News for Southern Pacific Company Atlantic Steamship Lines

TWO sister ships, the *El Almirante* and *El Capitan*, of the ocean-going hurricane deck type, each with a deadweight carrying capacity of 8,500 net tons on a mean draft of 25 feet 6 inches, have recently been built by the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., for the Southern Pacific Company, New York. The vessels were designed and built under the supervision of Mr. A. S. Hebble, superintending engineer of the Southern Pacific Company Atlantic Steamship Lines, to whom we are indebted for the following particulars:

The principal dimensions of the vessel are:

Length overall	380 feet 3¼ inches
Length between perpendiculars	364 feet
Beam, molded	51 feet
Depth, molded to hurricane deck	33 feet 6 inches
Depth, molded to main deck	25 feet 4 inches
Mean draft, loaded, in salt water, not to exceed	23 feet
Total deadweight capacity (at 2,240 pounds per ton)	6,200 tons
Designed speed	11 knots

As shown by the general plans, the design calls for a single-screw steamship with straight stem and elliptical stern rigged with two pole masts. Three complete steel decks are fitted fore and aft with an oriop deck in addition in the forward hold extending from the collision bulkhead to the after No. 1 hold bulkhead. The hull is constructed on the transverse system of framing with a single bottom throughout except in way of the engine room and twelve frames abaft of the engine room, where a double bottom is worked in. The compartment under the engine room are used for reserve feed water, and the compartments aft of the engine room for oil fuel. The forward and after compartments of the vessel are fitted with trimming tanks and a deep ballast tank is fitted aft of the engine room. The after peak tank is arranged for carrying fresh water for boiler feed and domestic purposes. Two fresh water tanks, with a capacity of about 4,500 gallons each, are located in the engine room and arranged for both boiler feed and domestic purposes. A cross bunker and side bunkers are fitted below the lower deck to carry oil fuel.

Cargo is handled through five centerline cargo hatches and in addition there are six side cargo ports on each side. The cargo hatches are served by cargo booms of wood fitted to the two steel pole masts and two steel derrick posts, each capable of handling 7½ tons and operated by

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twelve 9-inch by 10-inch friction geared, single cargo winches with watertight frictions. The cargo hatches are fitted with steel covers on the hurricane deck in accordance with the usual practice of the Southern Pacific Company.

HULL CONSTRUCTION

Built on the transverse system of framing, the scantlings of the hull generally are as indicated on the midship section. There is a single flat plate keel and a vertical keel continuous from peak to peak. Watertight bulkheads are fitted at the forepeak, between No. 1 and No. 2 holds, at the after ends of the engine room and ballast tank and at the after peak. These bulkheads extend to the main deck with the exception of the ballast tank bulkhead, which extends to the lower deck only. A watertight bulkhead is also fitted between the lower and main decks over the forward bunker bulkhead. Between the engine and boiler roms around the after end of the boilers a screen bulkhead is fitted.

The stem is a flat bar without rabbet with the lower end fitted with bearding angles for connecting the flat plate keel. The stern frame is a wrought iron forging in one piece with both inner and outer posts extending into the hull and with forged gudgeons.

The rudder is of the single-plate type built up with a forged post having wrought iron frames opposite each pintle, and is connected to separate forged stock by a horizontal flanged coupling. The pintles are of steel with composition casings working in lignum vitæ bushings in the gudgeons. The wear of the rudder is taken by a cast iron supporting collar, made in halves, which bears on a brass ring fitted on top of the main rudder bearing. The main bearing is brass bushed and a brass sleeve is fitted on the rudder stock in way thereof. A cast iron brass bushed bearing with stuffing box is fitted on the hurricane deck.

For about 125 feet amidships bilge keels are fitted consisting of 12-inch by 20-pound plate secured to the hull by a 5-inch by 4-inch tee bar.

The orlop, lower, main and hurricane decks are completely plated over; the upper and bridge decks are fitted with stringers, tie plates and wooden decking.

Throughout the peak tanks, holds and engine and fire rooms the vessel's plating is coated with cement composed of one part Portland cement to two parts of sharp sand mixed with fresh water. The double-bottom tanks under the engine room are coated with two coats of Portland cement wash. The fuel oil compartments are not cemented.

The holds are ceiled with two thicknesses of 1¼-inch first-class quality hard, yellow pine planking arranged with lap joints and fitted in portable sections. The side, bilge and center keelsons are sheathed with hard pine.

Accommodations for the officers are located, as shown on the general plans. The sailors' and firemen's quarters are located in the forward end of the after deck house, while the sailors' and firemen's mess rooms are located in the main house alongside the engine casing. Throughout the officers' and crews' quarters a steam heating system is provided. The heating pipes for the after house are taken from the steering engine steam and drain to the steering engine exhaust and overboard.

The vessel is fitted with a steam steering gear supplied by the Hyde Windlass Company, of the right- and left-hand screw type, with a double-cylinder engine about 8 inches diameter by 8 inches stroke. The steam stearing gear is located on the main deck aft, and is arranged to be operated from the pilot house by steel wire rope transmission connecting to the controlling valve of the engine. A hand gear of the right- and left-hand screw type is also fitted in the after wheel house.

The vessel is thoroughly equipped with drainage, fire, fresh water, ballast, plumbing and salt water systems and is lighted throughout by electricity supplied by two Sturtevant 10-kilowatt, direct-connected reciprocating engine-driven generating sets provided with forced lubrication and operated at 110 volts.

The mechanical telegraphs, located in the pilot house on the bridge and on the warping bridge, are of the Cory double-face type. A McNab direction and revolution indicator is also fitted in the pilot house, indicating the revolutions and direction of rotation of the main engine.

PROPELLING MACHINERY

Propulsion is by a single screw actuated by a triple-expansion surface condensing engine with cylinders 24½ inches, 41½ inches and 72 inches diameter by 48 inches stroke, designed to operate at 75 revolutions per minute with steam supplied at a working pressure of 200 pounds per square inch by two oil-fired Scotch boilers 15 feet 9 inches diameter by 11 feet 6 inches long, fitted with a heated system of forced draft. This machinery will enable the vessel under ordinary conditions at sea when running in a free course loaded to a 25-foot mean draft to maintain a speed of 11 knots on a fuel consumption of 1 pound of oil per indicated horsepower per hour.

The main engine is designed with large cylinder ratios, straight ports and low volumetric clearances, in order to produce the highest possible efficiency.

BOILERS

The boilers, which are of the single-ended, four-furnace type, with independent combustion chambers for each furnace, are arranged in one fireroom with the furnaces fore and aft. Designed for a working pressure of 200 pounds per square inch, the total effective heating surface of the two boilers is about 6,200 square feet. The boilers are arranged for oil burning only and are fitted with the Howden system of forced draft. The escaping gases, after leaving the heater boxes in the uptakes, pass to a single stack 6 feet 3 inches diameter with a height of about 80 feet above the base line.

The oil fuel burners are of the White patent liquid fuel type, suitable for burning Mexican oil of 11 Baumé gravity. The oil fuel system is provided with three steam oil heaters installed in the discharge line of the oil burner feed pumps. The heaters are designed with sufficient heating surface so that two of them, if necessary, can heat the oil to a temperature of 270 degrees Fahrenheit. Oil strainers in duplicate are fitted in the suction and discharge pipes of the oil feed pumps.

Two fuel oil pumps are arranged in duplicate, piped so that they can draw from either the forward fuel tanks or double-bottom tanks and discharge through the heaters to the oil burners. There is also an oil transfer pump for pumping oil to the various tanks.

Heating coils, consisting of a horizontal bank of 1½-inch wrought iron pipe with return bends, are fitted in each oil tank. The coils are of sufficient area to maintain the oil in the tanks at a temperature of 125 degrees Fahrenheit with the temperature of the outside water at 35 degrees Fahrenheit. The suction pipes to the portable feed pumps of the oil transfer pump are located close together and surrounded by two concentric heater coils, the inner coil about 24 inches in diameter and the outer about 30 inches in diameter, consisting of seven turns of 1½-inch black iron pipe.

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MAIN ENGINE

The main engine rests on a cast iron bedplate of box form in three sections with cross girders for supporting the main bearings, of which there are six, the four forward bearings being 14 inches long and the two after bearings 16 inches long. The bedplate is held to the foundation by 1¼-inch holding-down bolts of forged steel.

Each cylinder is supported by two cast iron housings of box section, the front housings being straight and the back housings of the A-frame type. The low pressure back housings carry a double bearing for the air pump beams, which are driven off the low pressure crosshead.

The cylinders are of the best quality close-grained cast iron, the high pressure cylinder being fitted with a cast iron liner. Both the high and intermediate pressure cylinders are fitted with piston valves and the low pressure cylinder with a double-ported slide valve. The valve chests on the high pressure and intermediate pressure cylinders are fitted at each end with a working liner, the low pressure valve chest is fitted with a cast iron false face. Balance cylinders with pistons of the ordinary type are fitted to the intermediate pressure and low pressure valve chests, while the low pressure valve is balanced by a balancing ring at the back of the valve.

The pistons are of cast iron, of box type, properly ribbed and fitted with hard cast iron bull rings and followers. The high pressure piston packing consists of strong rings tied by a solid bull ring, and the intermediate pressure and low pressure packing consists of double rings set out by springs.

The piston rods are all of forged steel, 5¾ inches diameter. The connecting rods, also of forged steel, are 9 feet long between centers, 5¼ inches diameter at the top end and 6¾ inches diameter at the bottom end.

The valve gear is of the Stephenson link type arranged so that the cut-off can be varied from 50 percent to 75 percent of the stroke on the high pressure cylinder, while the maximum cut-off on the intermediate pressure and low pressure cylinders is about 72 to 70 percent, respectively.

The main engine is reversed by a direct-acting type engine, 14 inches diameter by 20 inches stroke, while the turning gear consists of a single-cylinder reversible turning engine, 8 inches diameter by 6 inches stroke, located on the low pressure back housing and connected by double worm gearing to the crankshaft. Both the turning and reversing gearing can be operated with 90 pounds steam pressure, although they are sufficiently strong for full boiler pressure.

The crankshaft is 14⅜ inches in diameter, made in two sections. The thrust shaft is of the same diameter, with ten collars, 23½ inches outside diameter. The line shafting is 13¼ inches diameter and the tailshaft 14⅞ inches diameter.

ENGINE ROOM AUXILIARIES

Steam from the main engine is condensed in a cylindrical surface condenser with cast iron shell ⅞ inch thick and about 11 feet long between tube sheets, containing about 3,700 square feet of cooling surface. Circulating water is forced through the condenser by means of a centrifugal pump with 14-inch suction and 14-inch discharge, driven by a single-cylinder reciprocating engine 8 inches diameter by 10 inches stroke.

Attached to the main engine and driven by beams from the low pressure crosshead are the main air pump of the Edwards type and two bilge pumps.

The other pumps, all of which are special, the details having been modified and approved by the Southern Pacific Company, include:

One main feed, vertical duplex, 10 inches by 6 inches by 15 inches.

One auxiliary feed, vertical duplex, 10 inches by 6 inches by 15 inches.

One fire and bilge, vertical duplex, 12 inches by 7 inches by 12 inches.

One sanitary, vertical duplex, 7½ inches by 6 inches by 6 inches.

One hand oil pump.

Two fuel oil pumps, horizontal duplex type, 6 inches by 4 inches by 6 inches.

One oil supply pump, horizontal duplex, 7½ inches by 9 inches by 10 inches.

The auxiliaries also include a multicoil feed water heater with sufficient surface to heat the feed water to a temperature of 235 degrees Fahrenheit, with a pressure in the heater of from 13 to 15 pounds. A grease extractor is fitted on the discharge side of the feed pump.

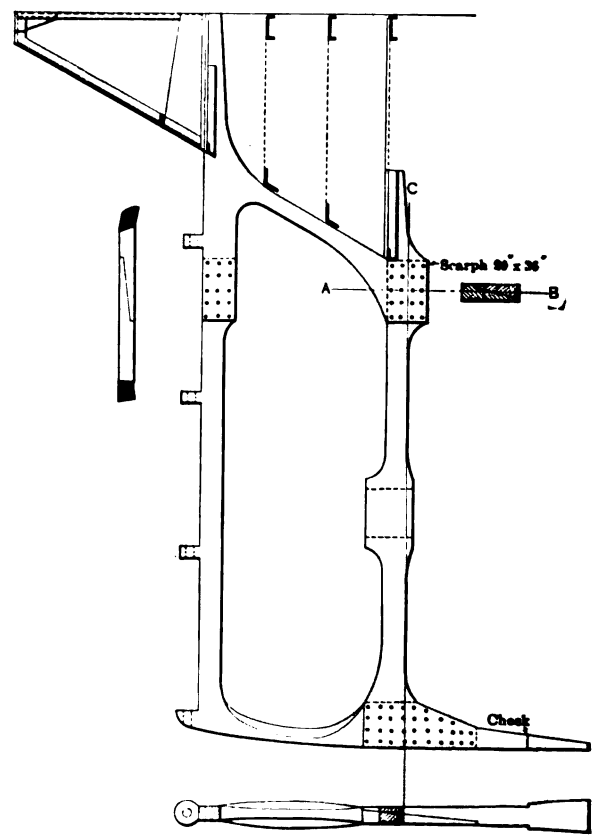
A forced draft blower, designed to maintain sufficient air pressure in the ash pits of the boilers when operating at not more than 300 revolutions per minute, to properly burn the fuel oil, is fitted to take suction from the fireroom space and discharge into the ducts for the forced-draft system. The blower is driven by an inclosed, single-cylinder engine fitted with forced lubrication.

Enlarging Lake-Built Vessels

BY JOHN A. MC ALEER

THE largest vessels that have gone to salt water from the Great Lakes yards via the canals, without being cut in two sections, have been 261 feet overall by 43½ feet beam.

To cut a vessel in two entails considerable expense at



Construction of Stern Frame

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both places; nevertheless a larger vessel than the above can be readily built and at no large additional expense. The plan involves the building of the stern frame, according to the accompanying sketch.

The frame is built in three sections, scarphed together as shown. The inner post forms one section, the arch piece with the upper end of the rudder post forms another, while the third will comprise the sole piece and the remainder of the rudder post.

In building the vessel the parts can be bolted together and erected as a unit. The whole after section from the inner post aft will be built and bolted temporarily to the hull proper, together with the upper part of the stern frame. Prior to the launching, the scarphs can be unbolted, the fantail section removed, dummy pieces fitted to fill out the scarphs, and certain of the plates bolted in place.

On the trip down the lakes the after section can be carried on deck and the vessel's motive power could be utilized, the propeller being removed and the tail shaft withdrawn on reaching the locks.

The advantages of this plan will be a vessel that will be perhaps 15 feet longer than the present ones, with an additional deadweight capacity of about 250 long tons. On reaching Montreal, one day in the dry dock should suffice to ship and permanently fasten the different parts.

Balance Weights for Reciprocating Engines

WHEN balancing a four-cylinder reciprocating engine on the Yarrow-Schlick-Tweedy system, the draftsman invariably finds that balance weights must be added to at least two of the crank webs, if a balance would be effected, the moment of the required weight being found by the force diagram. Generally speaking, the shape of the balance weight is such as to render it easy of manufacture, and perhaps the best practice is to include it in the web forging as shown in sketch, Fig. 1.

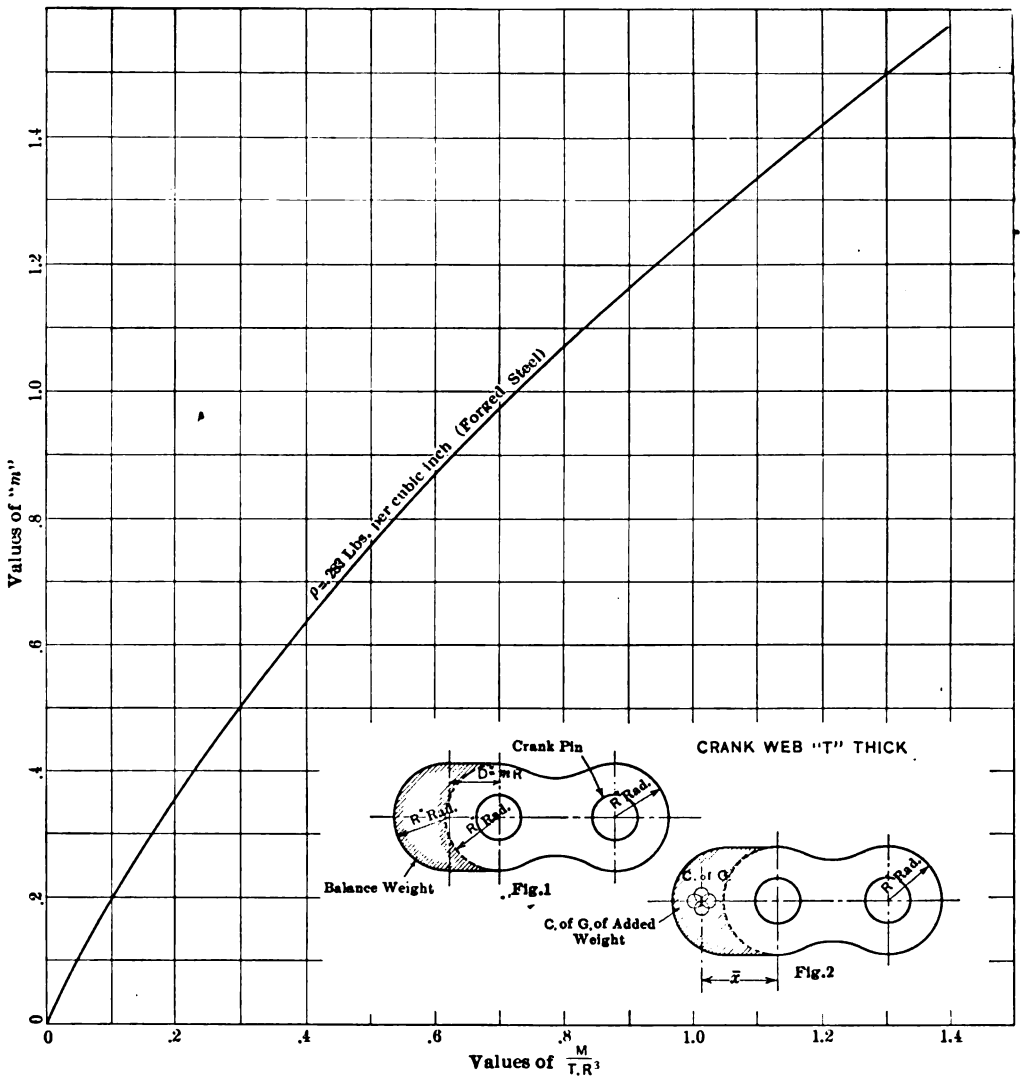

Fig. 3

To fix the dimensions for a weight of this type, in order that its moment shall be equal to that of the unbalanced force, involves both time and trouble if the usual trial and error process be adopted. But by following the method hereafter described such expenditure may be reduced to the minimum:

Let $2M$ = total moment of balancing force, pounds inches,
R = end radii of crank web (see Fig. 1) in inches,
T = thickness of crank web in inches,
D = distance from center line of crankshaft to center from which radius "R" bounding balance weight is struck (see Fig. 1) in inches,
ρ = density of material in pounds per cubic inch.

By equating D with M, T and R (three known quantities)

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we are able to find that dimension which immediately fixes the size of the balancing weight.

The result of such an operation gives:

$$D = -\frac{\pi}{4} R + \sqrt{\frac{\pi^2}{16} R^2 + \frac{R M}{T \rho}}$$

But by putting $m R = D$ and plotting m and $\frac{M}{TR^3}$ for a value of ρ previously decided upon, we are able with comparative ease to interpolate a value of m, which will solve the above equation.

An example may serve to illustrate the value of this method: It is found that the balance weights on one crank of a four-cylinder engine requires to have a total moment of 28,980 pounds inches. The thickness of each will be 11¼ inches, while the end radii are 15¾ inches.

Then $M = 14{,}490$,

and $\frac{M}{T R^3} = \frac{14{,}490}{11.25 \times 15.75^3} = .329.$

Interpolating from the curve, we find that when

$$\frac{M}{T R^3} = .329, \text{ then } m = .545$$

$$\therefore D = .545 \times 15.75 = 8.6 \text{ inches.}$$

As a check on the foregoing it can easily be proved that $\bar{x}$ (the arm of the center of gravity of the added weight about the crank axis), Fig. 3, is given by the equation:

$$\bar{x} = R\left(\frac{\pi}{4} + \frac{m}{2}\right)$$

and

$$M = \text{weight added} \times \bar{x}.$$

Duties of Newly-Trained Marine Engineers on Merchant Vessels—II

Taking Charge of and Running the Watch—Details of Scotch and Watertube Boilers—Method of Plugging Tubes

BY C. H. WILLEY

SINCE writing the previous article under the above caption, the writer feels that it was a little brief on the subject, and therefore is submitting a few more pointers for the benefit of those who are entering the marine profession for the first time.

Taking Charge of the Watch

When one engineer relieves another, he accepts the responsibility for the condition of the watch at the time of so relieving. Therefore, if there is reason for refusal to take the watch, the chief engineer should be called below to attend to the matter. If some minor breakdown has occurred, or some incident happened for which it is not deemed necessary to call the chief below, the relief officer can make note of it in the log, and the watch officer will initial it.

The relief officer is expected to put in appearance on the floor plates of the engine room fifteen to twenty minutes before eight bells, or the beginning of his tour of watch duty. This is not compulsory, but will be found good policy. A poor relief, or a tardy one, will soon get in wrong with his mates. Form the habit of getting below early, and satisfy yourself that things are as the engineer of the watch says. Many engineers have the habit of taking the watch over (after hearing the orders that are to be passed along) without making a personal inspection. When one knows that the man he is to relieve is O. K. this may be all right, but the newcomer will do well to see that the bearings are not above running heat, and that oil manifolds, or the lubricating tanks are filled, and drips and feed in proper state.

A running heat on board ship depends on the temperature of the engine room and the conduction of heat from the engine cylinders down through the frame.

See that there is sufficient water in the hot well or feed tanks, and note its temperature. (A good relief will leave the feed tanks pretty well filled and have the temperature as high as possible. This aids the new watch in keeping up steam while cleaning fires.)

Note where the water level is in the steaming boilers, the general condition of the fires, etc.

Find out what valves are open on the steam and feed lines.

Note whether the bilges are pumped, floor plates wiped down, and waste cans emptied.

Read the log to note what has been entered in it since your last watch. Then report to the watch officer that you are ready to relieve him and he will tell you of such special orders that may have been issued by the chief engineer since your last watch. These are generally briefly written in the watch order book of the engine room.

Running the Watch

After taking over the watch, about the first thing to be done is to clean the fires. After cleaning and getting them built up again, the ashes and clinkers are ejected or hoisted. Then the boilers allotted to your watch for tube sweeping should be blown with the steam or air hose.

During a day watch, when ready to sweep tubes, permission should be obtained from the officer of the deck, for if the wind is blowing forward, the soot blown up the stack will settle down over the chart house and bridge. Wind should be abeam when blowing tubes, but if a cargo steamer, this rule does not apply.

The watch officer should make a round of the bearings of both the main engines and the auxiliaries about once an hour, to feel them. While making these rounds, he should note the condition of the oil and water service, look for loose oil cups, pipes, bolts, etc. When feeling for the moving parts, considerable dexterity is required, and one has to make sure of his footing, for the ship may make a sudden roll and catch one off guard.

A creamy, pale, yellow thin lather coming from the ends of a bearing indicates that it is running fine. At

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low speed it has been found beneficial and economical to mix a bucket of soap solution, or wash, consisting of one-half bar of fine grade yellow soap, three-fourths bucket of water, and one quart of oil, and occasionally feed a little to each bearing; this washes out the bearing. It should then be followed up with clean oil.

The piston rods and valve stems, when running well, should present a bright polish; to get them in this condition they must be swabbed with a mixture of heavy cylinder oil and graphite about once an hour. A hot rod will turn the oil on its surface black or dark blue, and is readily detected by the smell of burnt oil. When a rod is running hot, it must be freely slushed with a squirt gun filled with soap solution, and intermittently swabbed with a tar brush. The oiler should stand by the hot rod until it is cooled.

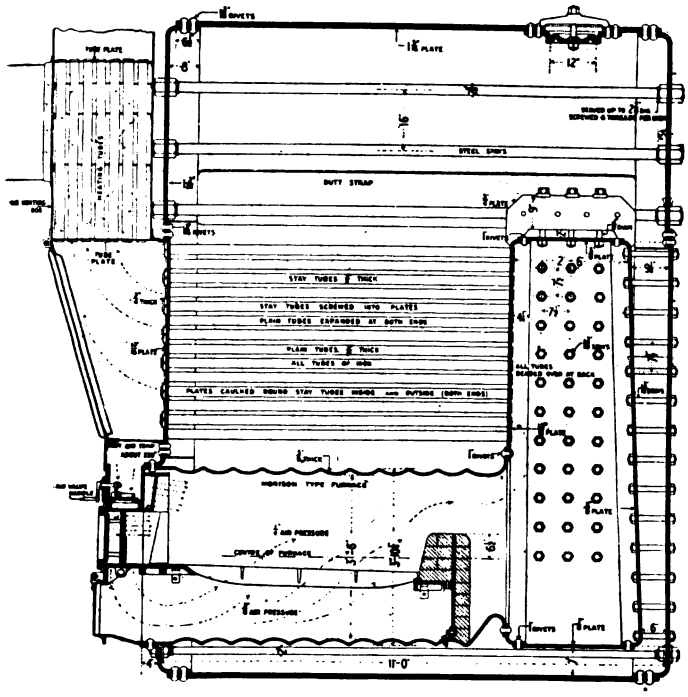

Fig. 1.—Section Through Scotch Boiler

Never under any conditions allow water to be supplied by a hose—this is dangerous; it will crack the rod or bend it and result in an accident.

If the gland can be safely slacked while running, it should be done; but if this is not possible, then the engine must be slowed or stopped till the trouble is cured.

The bridge must be notified of any pending trouble in the engine or firerooms in order that they may be prepared to handle the ship, should it be necessary to stop.

The thrust bearing calls for special attention at speeds above half power; the collars of a thrust shaft are guided between what are called thrust block shoes. These shoes are babbitted on both sides, and on these faces of babbit oil grooves are cut, which are connected to the oil cup or trough on the top of the shoe. The shoe is cored hollow and sea water is circulated in it through pipe connections. Generally the bottom part of the thrust bearing bed is formed into an oil-tight compartment and the collars of the shaft revolve in this.

Should the ship be required to tow another, then the strain on the thrust shoes becomes greater. This is true when running against strong head winds or currents.

When filters or grease extractors are installed in the feed lines, they are generally cleaned on the 4 to 8 A. M. watch. If this be your watch, see that they are well cleaned, for oil is dangerous in the boilers.

The watch officer should visit the firerooms quite frequently to see that coal is being burned properly and fires in good condition. The dead plates at the furnace should be kept clear of live fire.

See that the water level is at the proper height and the try cocks are tested. The newcomer must remember that on long rolls or plunging of the ship the water level is altered, and to get the true level one must watch the glass carefully for a few seconds.

In feeding a battery of boilers, the feed checks or stops should be so regulated that each boiler in use gets its regular supply of water. Should a man allow his boiler to run low, and he opens his feed supply wide, he endangers the other boilers, for they cannot get their allowance.

See that the firemen are using the dampers correctly and breaking up all large lumps of coal before firing, and that large clinkers are not allowed to lay in the fire.

Test the feed water for salt during your watch. (There is generally kept on the engine room desk a small bottle of silver nitrate solution.) A sample of the boiler feed is taken in a clear bottle, and with an eye dropper a few drops of this solution is put into the sample of feed water. If salt is present, it will turn the drops of silver nitrate to a milky appearance.

When salt is found, the saline contents of the water should be ascertained and entered in the log. The chief engineer is notified and will issue directions about blowing down of the boilers to reduce the saturation.

Make entries of all happenings in the steam log. Fill out all the data called for under each heading on the log.

Have everything wiped down, bilge strainers cleaned and bilges dry, and all things in shipshape for your relief. If anything has gone wrong, or things are not in condition to turn over to your relief, the watch should remain on until things are put right, or the relief is willing to take the watch.

MARINE BOILERS

A brief outline of the fire and watertube types will aid the newcomer. The old Scotch boiler continues to be widely used for cargo and merchant vessels. A sketch of a familiar design is given in Fig. 1. This is known as a single-ended three-furnace type. There are also double-ended Scotch boilers (furnaces and combustion chambers in each end). Practically they are as two single-ended, placed with back to back and riveted together with the rear sheets or heads removed. Each furnace has its own combustion chamber and nest of tubes.

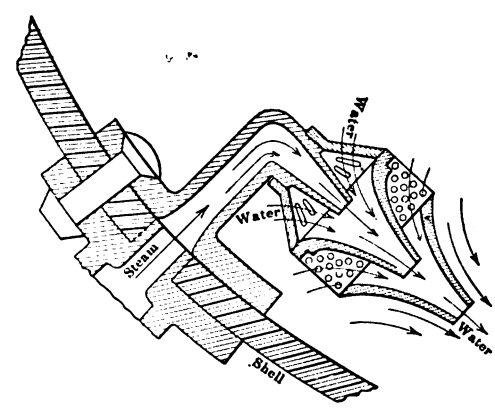

Fig. 2.—Hydrokineter

On account of the large body of water contained in the shell of the Scotch boilers when raising steam, the water

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has to be agitated or circulated to facilitate the work and save time. When fitted with a hydrokineter, as shown in Fig. 2, the water is circulated by supplying it with steam taken from another boiler. When no hydrokineter is fitted, the water can be circulated by a feed pump, taking from the bottom blow connection and pumping back through the feed checks.

When starting fires the wing furnace fires are lighted off first to aid circulation. It requires from eight to ten hours to raise steam to working pressure in Scotch boilers. It can be done in less time, but injury is liable to result from rushing a cold boiler into service.

It is possible to plug a leaky tube in this type of boiler while steaming. One form of leak stopper is shown in

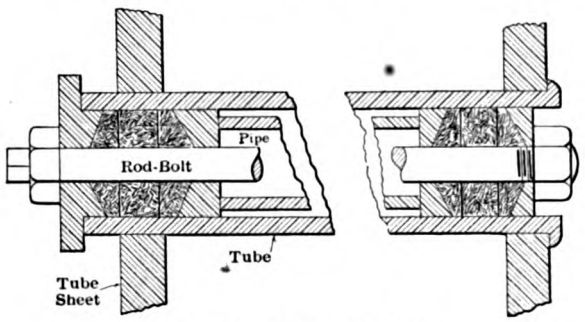

Fig. 3.—Fire Tube Leak Stopper

Fig. 3, consisting of a through rod, four cup washers or packing plates, and a piece of steel tubing or pipe. The placing of this leak stopper is a hot, uncomfortable job, and has to be done quickly. The packing washers are cut a little smaller in diameter than the inside of the tube, and when the device is in place a wrench is used on the square of the front end of the king bolt and the nut set up as tight as possible. This squeezes the packing out against the inner walls of the tube, making a tight joint.

Watertube Boilers

Stationary men are better acquainted with the watertube boiler than with the Scotch or fire tube, but there is considerable difference in the setting and construction of the land and marine type of watertube boiler. The Babcock & Wilcox and the Heine safety boiler are the two most widely adopted for marine use. The Stirling, and also Ward, boilers are constructed along somewhat the same lines. A description of the Babcock & Wilcox will serve to acquaint the newcomer with this class of boiler.

The watertube boiler is used on almost all vessels of our Navy, while hitherto but few merchant ships have had them. (Recently a large contract was awarded to the Heine Boiler Company to fit out ships now building with their type of tube boiler.)

Fig. 4 shows a section through one of the latest types of Babcock & Wilcox boiler. This is equipped with a superheater. The path of the hot gases is shown, as are also the lanes of water circulation. The B. &. W. is known as one of the free circulation class. The tubes incline from front to rear 15 degrees from the horizontal. The circulation is as follows: Starting from the drum through the downtake nipples to the front headers, thence through the 2- and 4-inch tubes to the back headers, up through these to the 4-inch circulating tubes, through which it returns as steam and water to the drum.

The tubes that form the heating surface are arranged in separate vertical elements. Each section is made up of a series of straight tubes expanded at each end into wrought steel headers of corrugated pattern. This form

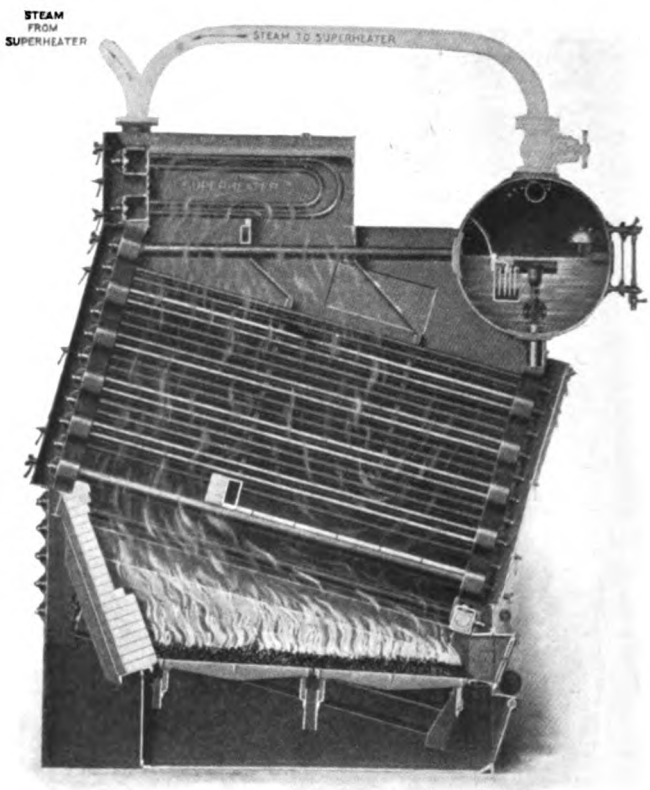

Fig. 4.—Section Through Babcock & Wilcox Watertube Boiler with Superheater

of header staggers the position of the tubes, which completely distributes the hot gases over the entire heating surface.

Extending across the front of the boiler and connected to the lower ends of the headers by 4-inch nipples are two separate wrought steel boxes known as mud drums. At the lower sides and in the center, 6-inch square section wrought steel side boxes are installed. These are connected to the uprights, and these in turn to the headers. These boxes are filled with water, which serve

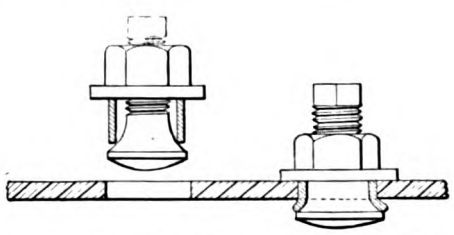

Fig. 5.—Tube Hole Plug for Watertube Boiler

to absorb the heat and aid the rapid steaming of the boiler.

Should a tube be found defective, it may be renewed or temporarily plugged, for both ends of the tube are accessible by removing the handhole plates of the header near the injured tube. For plugging tubes, a tapered plug is used, in the large end of which is drilled and tapped a hole for a screw bolt. This provides a means for removing the plug.

When it becomes necessary to remove the tube, and no new ones are at hand to install, a tube hole plug, as shown in Fig. 5, can be readily installed.

(To be continued.)

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Development of Machinery in the United States Navy During the Past Ten Years*

Trials of Delaware and North Dakota, and Experience with Oil Fuel—Turbine-Driven Blowers—Cruising Economy in Battleships

BY CAPTAIN C. W. DYSON, U. S. NAVY

In the contracts for the *Delaware* and *North Dakota* appeared for the first time a requirement for the measurement of the steam used, this for the *North Dakota* being accompanied by guarantees that the following steam consumptions per shaft horsepower would not be exceeded:

Full speed	15.1 pounds
19 knot	16.1 pounds
12 knot	23.2 pounds

The *Delaware's* trials took place off Rockland, Maine, in October, 1909, and those of the *North Dakota* off the same place in November of that year. The results obtained were:

Ship.	12-knot.		19-knot.		Full speed.	
	Del.	N. D.	Del.	N. D.	Del.	N. D.
Speed	12.24	12.04	19.217	19.21	21.56	21.64
Indicated horsepower (main engine)	3,905	.....	16,602	.....	28,578	.....
Shaft horsepower (main engine)	.....	3,757	.....	16,713	.....	31,862
Coal per indicated horsepower or shaft horsepower	2.673	2.64	1.795	1.63	1.888	1.71
Water per indicated horsepower or shaft horsepower	19.37	27.12	13.91	16.67	14.32	14.

In advertising the results of this first large Curtis turbine installation, the advocates of the turbine in comparing the two vessels religiously confined themselves to the comparison of coal per horsepower, and always called your attention to the fact that a shaft horsepower was only 92 percent of an indicated horsepower, and that, therefore, the fuel consumptions were:

	12 Knot	19 Knot	Full Speed
Delaware	2.9 pounds	1.95 pounds	2.05 pounds
North Dakota	2.64 pounds	1.63 pounds	1.71 pounds

per shaft horsepower, thus indicating the vastly greater economy of the steam turbine and its therefore much greater superiority as a marine engine.

They carefully neglected, however, to call attention to the following comparison, which gives the measure of the relative propelling efficiencies of the two types of machinery:

	Total Pounds of Water		
Speed	12 Knots	19 Knots	Full Speed
Delaware	83,463	243,810	422,931
North Dakota	101,883	281,784	445,979

These figures, which glaringly demonstrated the superiority of the reciprocating drive as compared to the then current turbine practice, have been maintained and even increased by the *Delaware* in service as the efficiency of the *North Dakota's* turbines rapidly decreased, while at the same time the turbines became unreliable, finally necessitating her withdrawal from active service with the fleet until new machinery could be built and installed.

Destroyers of 1906

No torpedo boats or destroyers had been appropriated for since the completion of the first lot of sixteen destroyers, which had occurred in 1901-1902, these having been authorized in 1898 and having taken from three to four years for completion.

These original destroyers were of about 7,500 I.H.P., and were designed for 28.5 knots, trial speed. After many difficulties and a reduction of trial speed to 27.5 knots they were finally squeezed through and accepted. Great troubles were experienced with their light and fast running reciprocating engines, and with their forced draft blowers, which were also driven by reciprocating engines.

In 1906 and 1907 five more destroyers were authorized. The estimated I.H.P. for this speed was 10,000, and the Navy Department prepared plans showing the use of reciprocating engines for this power. In advertising for bids for the construction of these vessels bidders were invited to submit plans showing turbine machinery both with and without cruising turbines, and were given to understand that, other things being equal, turbine installations would be preferred.

These vessels as finally contracted for were all of three-shaft Parsons turbine type with a H.P. and I.P. turbine, one on each outboard shaft, for cruising purposes. The vessels were all coal burners, and while, during their construction, it was proposed to change to oil fuel, the cost of change and the difficulties in the way due to progress of construction were found to be so great that the idea was abandoned.

There never was any doubt in the mind of the department as to the desirability of displacing the unreliable high speed engines that had been previous practice for these light high speed vessels by the more reliable turbine, and the step was taken with no hesitation. There was also another step in advance made at the same time, and this step was even of more value, if possible, than the adoption of steam turbines for the main propelling engines.

Steam Turbine-Driven Blowers

One of the great sources of failure to hold high speed for any long continued period of time with all classes of vessels had been the continually recurring breakdowns of forced draft blowers with engines of the reciprocating type. These had been done away with, and blowers driven by electric motors substituted for battleships, beginning with the *Michigan* and *South Carolina*, as already stated.

In two of these five destroyers appeared for the first time the turbine driven, forced draft blower. In laying down the plans for these vessels the Bureau of Steam Engineering had scanned the market closely to find turbine driven blowers of proper design to install for the work required. Not being able to find any such in existence it invited in the specifications the installation of such type in place of the type directly specified. Meanwhile it succeeded in awakening the interest of the Terry Steam Turbine Company in the proposition, and by the time the contracts for the construction of the vessels were awarded this company had developed what appeared to be, on paper at least, a very satisfactory unit.

The Cramp Ship and Engine Building Company were

* Reprint from the Journal of the Society of Naval Engineers, continued from November issue.

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quick to see the advantages in this new unit, and proposed its installation in the two vessels building by them. This proposal was approved and the units installed. The contractors for the remaining three vessels, however, adhered to the old reciprocating engine blowers, arguing the greater steam cost with the small, inefficient turbines, losing sight, however, of the fact that with feed heaters installed and with turbine main engines in which excess auxiliary steam can be used in the heaters and in the low pressure stages of the turbines, steam economy of auxiliaries only used when the main engines are in operation or used to only a small extent in port, does not cut any great figure in the general economy of the machinery plant. Also that the greater reliability of the turbine blowers would, if realized, more than offset any possible loss in economy, as the forced draft blowers, in rate of importance to a destroyer, are as necessary as a good heart is to the human body.

The blower units as fitted were of the vertical, direct connected turbine type, with single stage Terry turbines driving what are known as multivane fans of the Sirocco type. These fans are located directly at the base of the intake ventilators and discharge throughout their complete circumference into what is called a diffuser chamber, in which the velocity of the discharge becomes reduced and the air pressure after discharge from the fans increased.

The diffusion chamber is formed by two plates forming frustums of cones with the bases separated several inches at the outer circumference; the inner edges of the plates at the fans being separated to the width of the fan blades.

When the vessels carrying the new type of blowers were tried great trouble was experienced, due to two fans discharging into the same fireroom; unless the fans were running at practically the same speeds, that fan which was doing the least work would be wrecked on account of the air being forced back through it. After considerable trouble and experiment, the cause of the trouble was located. It was due to the too great width of discharge opening from the diffuser chamber. This error was corrected and the fans by their later performances instilled such confidence that no other type of blower than that of the turbine driven has since been considered for destroyer work, and in later vessels of other types it has even shouldered the electric driven fan out of the way, as the flexibility of control is so much greater.

Experience with Oil Fuel on the Delaware and North Dakota

The oil fuel handling of these two vessels varied in one respect, and that was in the location of the settling tanks, that of the *Delaware* being located aft alongside the engine room, while the *North Dakota* followed the bureau plans and had a small cylindrical tank located in the upper part of each fireroom. This location on the *North Dakota* was later credited with a disastrous fire on that vessel in which several lives were lost. The real cause of the disaster was, however, the fact that each of these tanks was fitted with a glass gage for indicating the height of oil in the tank, and oil vapor having collected on the flat tops of the Babcock & Wilcox boilers, it became ignited in some unknown manner, the flash resulting broke the gage glass and, the booster pump supplying oil to the tank being running at the time, the oil was forced out and burned like a gigantic torch until the pump was stopped and the tank completely emptied.

Orders were immediately issued by the department prohibiting the use of gage glasses on oil fuel tanks unless such glasses were fitted with spring valves that were open only while readings were being taken, the valves closing automatically when released.

Other troubles were experienced with the oil fuel due to the inexperience of all hands concerned with it, including the makers of the oil fuel apparatus. The burners as originally supplied were of sufficient capacity to deliver the full power condition, and this, on account of insufficient volume of furnace above the grates, resulted in heavy carbonization on the grates and bridge walls and in very heavy smoke formation. All manner of criticism was leveled at the system employed, and it was only by taking a strong stand on the subject that the bureau prevented it from being superseded by air or steam atomization. The succeeding years have demonstrated the wisdom of the step, and we hear no more of propositions to use any other system.

1907-1908

The next naval appropriation bill provided for two battleships of the dreadnaught type and for ten destroyers.

The battleships, later named the *Florida* and *Utah*, were very similar to the *Delaware* in hull lines, but of about 1,000 tons greater displacement, requiring a slightly greater towrope power at low speeds and slightly lower towrope power at 21 knots than was required for the previous vessels.

In laying down the machinery arrangement plans, the fireroom arrangement of boilers and piping was practically duplicated, the boilers, however, being slightly increased in heating surface over the total heating and superheating surface of the earlier vessels, while no superheaters were installed, the Parsons marine turbine not being adapted to use superheated steam on account of the abnormally small radial blade clearances which must be provided in that turbine in the high pressure stages in order to preserve, or rather realize, a good efficiency.

Following the British lead, the engine rooms were laid out showing a four-shaft installation of Parsons turbines with H.P. turbines, both ahead and astern, on the outboard shafts, and L.P. ahead and astern turbines on the inboard shafts. The inboard shafts likewise carried cruising turbines, a H.P. turbine on one and an I.P. turbine on the other, so that at low speeds the steam would just pass through the H.P. cruising, then the I.P. cruising, thence to both H.P. mains, finally through both L.P.'s to the condensers. At intermediate speeds it was admitted to the I.P. cruising direct, the H.P. cruising running in vacuo. At higher speeds both cruising turbines were cut out and ran in vacuo.

Necessity for Cruising Economy in Our Battleships

When the conditions under which our battleships must operate are compared with those which faced European nations in the period directly preceding the present great war, a war which they all evidently had in mind in the preparation of the machinery designs for their vessels, it is readily understood why they could afford to neglect any provisions for insuring great cruising radius, while with us the necessity for providing the maximum cruising radius is imperative.

The former nations were providing for operations in confined waters such as the North Sea and the Mediterranean, where they were never far from their bases. The runs from base to station were short, and occasion might arise where these runs would have to be made at high speed. Refueling became a simple proposition. Under the conditions foreseen, high speed was more desirable than cruising radius, and the latter was sacrificed.

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Turning now to the conditions confronting us we see the entire western half of the North Atlantic ocean from the northern shores of South America to Greenland on our eastern sea front, and the entire line from Seattle to Panama to the southward, and from Seattle to Honolulu, thence to Guam and on to the Philippines, and still further to Samoa, requiring our attention. The areas to be covered are great and the distances to bases and from base to base in some cases are magnificent. Fuel economy is of the highest value, even predominates over high speed, as the refueling problem becomes a serious one and the greater our bunker capacities and the greater the fuel economy of our machinery, by so much is the seriousness of the problem reduced.

It will be shown later how this question had an important bearing on the decision of the department as to the types of machinery to be fitted in some of our subsequent vessels.

Beyond the installation of Parsons turbines in these two vessels, the only point of practical engineering interest was a change in the basis of design of feed heaters. The old empirical rule used for years in the design had been to allow one square foot of heating surface for every ten designed I.H.P. Such a rule took no account of the amount of heating medium, which in the case of naval vessels is the auxiliary exhaust steam, the temperature of the heating medium, nor of the amount of feed water to be heated. During the year preceding the designs of these vessels the Bureau of Steam Engineering had developed a feed heater which, when constructed, had been thoroughly tested out at the Engineering Experiment Station under conditions of exhaust pressure and temperature corresponding to those used in service. From the results of these tests design curves were prepared, and from these curves the necessary surface for the feed heaters was obtained.

In connection with these tests comparative tests were made with and without whirler strips in the tubes, these whirler strips being nothing but ribbons of sheet copper twisted to a pitch of 6 inches and inserted in the tubes, extending their full length. These whirlers, by causing every particle of water flowing through the tube to be brought into intimate contact with the heating surface, increased the efficiency of the heater about 25 percent.

The heaters developed from the design curves required a total heating surface for both heaters, inclusive, of 700 square feet, while those of the preceding vessels under the old empirical rules required 2,100 square feet.

In service the new heaters, paradoxical as it may seem, have done much better work than the old ones, delivering the feed at considerably higher temperatures and eliminating the constant troubles of leaky joints that had formerly been experienced.

I am giving the above as an illustration of the beneficial results that may be expected, both in small and in large problems, by carrying out a series of well thought out experiments, and am happy to be able to say that this is only one of the many instances where the Engineering Experiment Station has demonstrated its value to the Bureau of Steam Engineering and through it to the naval service in general.

Of the ten destroyers, two were fitted with Curtis velocity compounded turbines on two shafts, two with Zoelly turbines of a similar type, and six with Parsons turbines on three shafts. The Curtis and Zoelly turbines were newcomers in the destroyer field in this country, but from reports received at the time, the Zoelly turbine was in successful operation in the German navy. When these vessels were completed and put into active service, those with the Curtis and those with the Parsons turbines gave satisfaction from the very start. In a short time, however, the vessels fitted with the Zoelly turbines demonstrated that either our information from abroad as to the success of this type of turbine was incorrect or that the American builders did not understand its construction sufficiently well to build a good turbine. Both vessels gave trouble, but while these troubles appear to have been practically conquered in one of the vessels, in the other the turbines went from bad to worse, and are now being replaced with machinery of a different type.

The Navy Department, with these vessels, definitely adopted oil as the approved fuel for destroyers, the system adopted being that of "pressure atomization," commonly, though erroneously, known as "mechanical atomization." The air for combustion was supplied by turbine driven blowers of the open type, this type of unit having come to stay.

These being the first installations of all oil fuel, they became the school of experience from which many practical points in handling oil fuel were learned. Among these may be mentioned the following as being practically basic necessities for successful fuel oil burning:

1. Steady pressure in oil fuel supply lines to burners.
2. Burners which will efficiently atomize the fuel and, for boilers of the express type, throw a long flame.
3. High and steady air pressure in the firerooms, which prevents leakage of unburnt gases through the boiler casing joints into the firerooms and also provides a life insurance for the fireroom force by preventing flare backs of flame and blow backs of steam in cases of tube rupture.
4. High velocity of air entering furnaces to insure intimate mixture with atomized oil throughout length of flame, thus preventing wreckage of furnace linings by heavy pulsation.
5. Efficient and large areas of fire brick furnace linings, well secured, to prevent radiation losses and to increase furnace efficiency.
6. The absolute necessity of so locating oil burners that no unburnt oil can come in contact with boiler tubes or fire brick lining of furnace if smokeless burning is to be obtained and if the building up of heavy carbon deposits is to be avoided.
7. Ample air supply to insure an excess of air when running at full power, as this excess is necessary to insure smokeless combustion.
8. Avoid relatively high gas pressures in the boiler passes and uptakes, as such pressures render furnace conditions unstable and tend to produce pulsation, with consequent destruction of furnace linings.

(*To be continued.*)

Annual Meeting of Institute of Naval Architects

The next annual meeting of the Institute of Naval Architects will be opened in London on March 20, 1918.

Annual Meeting of American Society of Mechanical Engineers

The thirty-eighth annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, New York, December 4-7. The dominant theme of the meeting will be The Engineers' Part in the War and an entire day will be devoted to a discussion of the service of the engineer to the public in times of crises.

At the opening session honorary membership will be conferred upon Major-General George W. Goethals and the meeting will be addressed by Hon. William H. Taft, ex-President of the United States.

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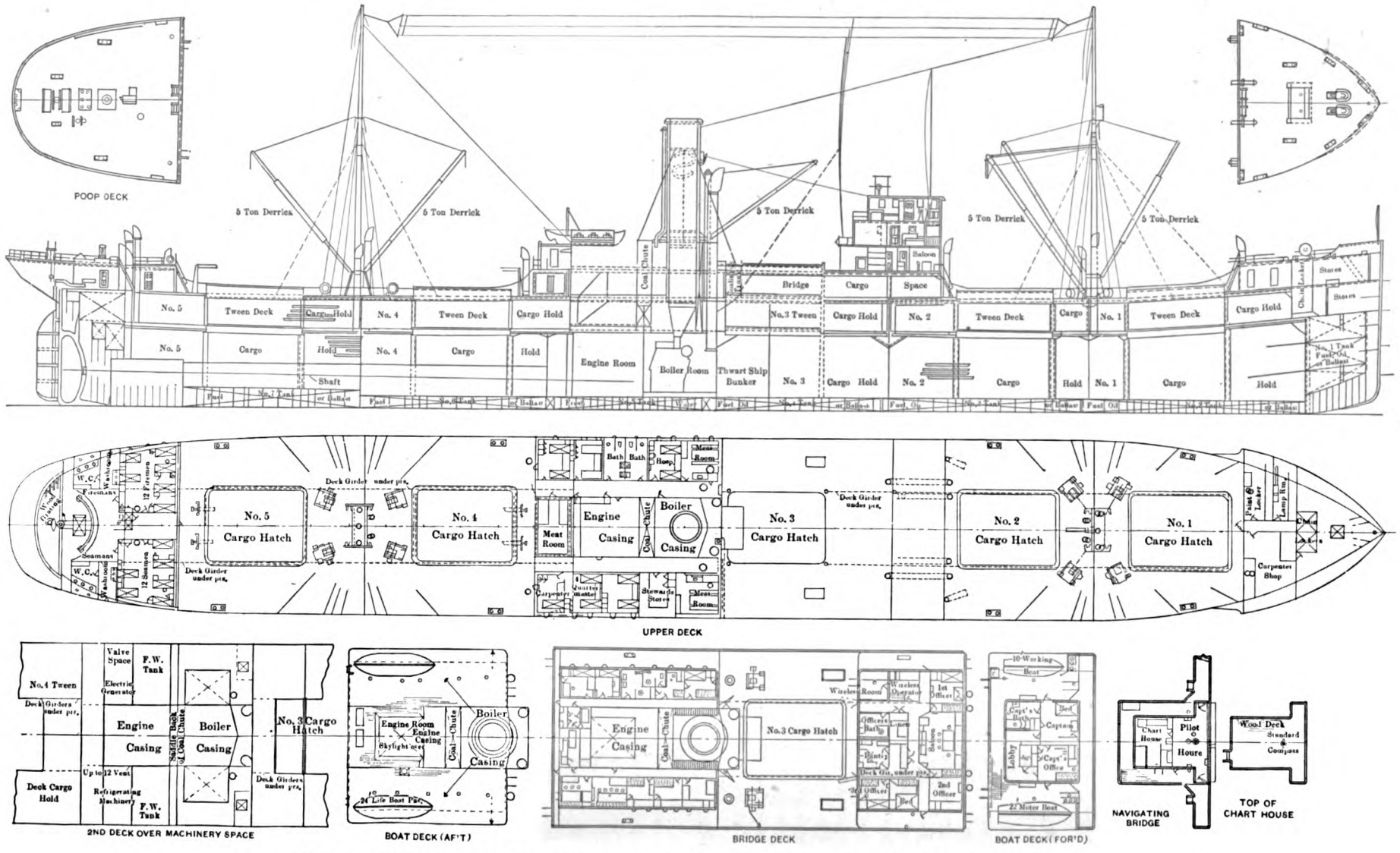
GENERAL ARRANGEMENT PLANS OF FABICATED STEEL CARGO SHIP

By Chester Shipbuilding Company, Ltd., and Merchant Shipbuilding Corporation, Chester, Pa.



Profile and Deck Plans of Vessel 401 Feet Long, 54 Feet Molded Beam, 32 Feet 9 Inches Molded Depth and About 8,800 to 9,000 Tons Deadweight Carrying Capacity.

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Fabricated Ships*

Methods of Construction Developed by Chester Shipbuilding Company

BY R. H. M. ROBINSON

RECENTLY the term "fabricated ships" has become one of public interest. A fabricated ship may be defined, briefly, as a ship on which the work of punching and shaping the plates and shapes and, to some extent, assembling and riveting, is done in a fabricating shop, ordinarily employed for bridge or tank work, as distinguished from the usual practice of doing it in a shipyard punch shop.

So far as the writer knows, the fabricated ship is a product of American progressiveness. The principal credit for carrying out the fabricating idea is due to Mr. C. P. M. Jack, now consulting engineer, and to Mr. Max Willemstyn, engineering manager of the Chester Shipbuilding Company and of the Merchant Shipbuilding Corporation, and it would be improper to neglect to state that the ideas of Messrs. Jack and Willemstyn could probably not have been carried out except for the interest and assistance given them by Mr. Jas. A. Farrell, president of the United States Steel Corporation, and by the officials of the American Bridge Company.

The construction of fabricated ships makes it possible to have the steel work done by those who are specialists in the line of fabricating steel with all of the special tools and labor-saving devices at their disposal. It relieves the mind of the shipyard operator from the multitude of detail that goes with such work, reducing his problems to those of engineering, erection, riveting and assembling by the workmen, and to the installation of other units of outfit and equipment.

Ship Shapes and Plates to Be Used

The type of ship which the Chester Shipbuilding Company has built, and which it and the Merchant Shipbuilding Corporation are now building, provides for the use in all places of conventional ship shapes and ship plates, subject to the rules, inspection and survey of the registration society, both as to quality and material, dimensions, riveting and other matters. These vessels are cargo carriers of about 8,800 to 9,000 tons deadweight capacity with poop, topgallant forecastle and bridge, the latter being about 124 feet long. The decks, with the exception of the poop and topgallant forecastle, are without sheer at the center line. Complete double bottom for the carrying of fuel oil or water ballast is fitted. The machinery is located amidships and consists of high and low pressure turbines, driving a single screw through reduction gears.

In the emergency which has recently arisen there have been proposed ships constructed from bridge shapes and universal mill plates, with regard to which the writer has no personal detailed knowledge. It would appear to him that there might arise certain difficulties in using this character of material in the construction of ships, but he would prefer to leave to those who are personally cognizant of the matter any questions in regard to this.

The manufactured ship is a commercial possibility only if duplicate ships are built and, therefore, this policy was adhered to as far as possible from the beginning in contracting for the ships at Chester, there being but four different classes. These classes are as follows:

* Paper read before the Society of Naval Architects and Marine Engineers, New York, November, 1917.

Types of Ships

1. Tank ship of about 9,000 tons deadweight capacity, fitted with cylindrical tanks on Jack's system. The vessel is built with topgallant forecastle, poop and short bridge. The main deck at centerline and top of expansion trunk are without sheer. Cylindrical tanks extend from tank top to under side of main deck, and a continuous trunk extending between poop and topgallant forecastle takes care of expansion and provides a working deck between the bridge, poop and forecastle decks. Machinery is located aft and consists of a high and low pressure turbine driving a single screw through reduction gears.

2. Two-decked freighter of about 8,800 to 9,000 tons deadweight capacity having poop, topgallant forecastle and bridge, the latter being about 124 feet in length. This vessel is built with sheer. Complete double bottom for the carrying of fuel oil or water ballast is fitted. Machinery is located amidships and consists of high and low pressure turbines driving a single screw through reduction gears.

3. Shelter-deck freighter of about 9,300 tons deadweight capacity, having poop, topgallant forecastle and bridge. Complete double bottom for the carrying of fuel oil or water ballast is fitted. Machinery is located amidships and consists of high and low pressure turbines driving a single screw through reduction gears.

4. Two-decked freighter of about 8,800 to 9,000 tons deadweight capacity, having poop, topgallant forecastle and bridge. The decks, with the exception of the poop and forecastle decks, are without sheer at the centerline. Complete double bottom for the carrying of fuel oil or water ballast is fitted. Machinery is located amidships and consists of high and low pressure turbines, driving a single screw through reduction gears.

Except as to details which may be modified to provide for ease of fabrication, the fabricated ship does not differ essentially in structure from any ship of a similar class. One of the prime questions involved is that of multiple punching.

Multiple Punching

The greatest difficulty with the arrangement for multiple punching lies in the fact that the minimum distance from center to center of punch dies in a multiple punch is regularly 2 inches, which distance can occasionally be reduced to 1⅞ inches.

The term "multiple punch" implies that the spacing of rivets is to be laid out so that the spacings of rivets in different successive rows are in multiples of each other or in multiples of 2 inches. Take for example a butt spacing of four diameters of ⅞-inch rivets equal to 3½ inches. The frame riveting in this case could be six diameters or 5¼ inches, which is no multiple of 3½ inches, and neither is 3½ inches a multiple of 2 inches.

A compromise is made in this case by making an average butt-spacing of 3½ inches, which can be done by spacing in groups of three, viz., 3¼ inches, 4 inches, 3¼ inches. The punches for the butt and frame spacing would be spaced in the machine as follows: 3¼ inches, 2 inches, 2 inches, 3¼ inches. The first, second, fourth and fifth punches would be used for the butt-spacing. The first,

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third and fifth for the frame spacing allowing for a 5¼-inch spacing.

Where the butt-spacing is 3½ diameters and the frame spacing 7 diameters, such as on smaller size ships, there is not much trouble, but the multiple punch is hardest to apply on the 9,000-ton, clear-hold, single-deck ships, with their 5½ and 6 diameters frame riveting. Again, on the larger ships with 4-inch butt-spacing it is easier to be according to rule, and it should be here noted that Lloyd's Register of Shipping has been very progressive and broad-minded in allowing the use of the average spacing instead of the strict and absolute adherence to stated rules.

The first thing to do on a ship designed for multiple punch is to arrange the midship section in such a way that all longitudinal rows of holes fall in line with the principles just explained; second, to arrange the plate width so that the greatest number of equal width plates are obtained; third, to see that, if possible, each plate is symmetrical about the long centerline of the plate, so as to avoid any possible countersinking errors. No templates are required for setting the multiple punch, which is entirely done from the typical rivet spacing drawing.

In staggered riveting, the minimum longitudinal spacing between the rivets of one row and those of the other is 1 inch, but 1⅛ inches is preferable. This space is required for the stops and pawls, which stop the table during the downward stroke of the punch-head. It is, of course, possible to reduce the minimum space to small fractions, but then the human element of error is introduced, as a man has to insert a liner between stop and pawl, equal in thickness to the change in spacing wanted. Otherwise the machine is electrically controlled, except the throwing in of the clutch for punching.

A "pole," being a batten about 3 inches wide by ½ inch thick and of such length as is required, is used as template for the longitudinal spacing. Steel stops are inserted in the holes of the batten corresponding with rivet spacing, or, on the newest machines, steel stops are set up in a steel rack to suit the pole. Different color of light is shown where butts, edge-seams, frames, etc., occur, and the man on the levers is acting solely according to these colors.

The multiple punches have, as a rule, only three or four set-ups; that is to say, one set-up for butts, one for edge-laps, one for frames, one for, say, intercostal angles in conjunction with the edge-laps. In this case the watertight bulkheads could not be punched if the holes would not entirely coincide with one of the four set-ups. It is possible to omit a few holes in some of the set-ups, but this is done only by hand. The man on the punch can release any number of punches temporarily by disconnecting the gag-operating gear for these punch dies.

The Chester Shipbuilding Company, Ltd., has, wherever possible, carried out the idea of duplication and standardization, but very often has had to abandon it in the detail. The hull, engines, boilers, and, in fact, all large items for a group of ships, have been duplicated.

The dimensions for all but two ships contracted for by the Chester Shipbuilding Company are: Length, 401 feet; molded breadth, 54 feet; molded depth, 32 feet 9 inches. Some have had sheer, but, in the latest type, sheer is dispensed with and a raking forecastle and poop substituted, giving the effect of sheer, but simplifying the work of manufacture.

The results of the fabrication in the Bridge Company's mills as outlined above is beyond criticism. Work is fair, rivet holes require no reaming, and the resulting fit of joints and watertightness is excellent. Constructing a ship becomes to a great extent a problem of routing, handling and erection of material and of riveting.

The Chester Shipbuilding Company, Ltd., and the Merchant Shipbuilding Corporation are now building some sixty-eight ships on the manufacturing principles outlined above. It is expected to embody even more than has been possible in the past the manufacturing idea, thus making it possible, in this day of labor shortage, to do a maximum of work with a minimum of skilled shipyard labor of the conventional kind.

The Men Who Will Build the Ships

(*Concluded from page 529.*)

The Department has also been in touch with numbers of employers and with many large labor organizations, especially such organizations as are directly affected in shipyard work, and has the pledged support of both. The labor organizations have very loyally conducted an examination into the number of workers whom they can find to assist in the shipbuilding programme. These number many thousands and will be produced as the need for their services is found.

There are about eight thousand American towns and smaller cities above village size not large enough to support a labor exchange alone, yet each able probably to supply a half dozen or more skilled workers qualified for shipbuilding. The Service will shortly send a force of skilled traveling agents to comb these communities, find and ascertain the respective qualifications of these workers and distribute them to the yards. The Public Service Reserve will be used to locate them and to avoid crippling local industries in getting them. The Department has compiled a list of 62 cities, none having less than 30,000 population, in different parts of the United States, which have now no public employment office. As the employment office is to employer and worker exactly what the bank is to the investor and borrower, it seems strange that any city of size should be without such an employment office. In the present state of affairs such a condition can no longer exist. England has found its 2,100 employment offices indispensable. We must increase our now feebly supported system; it cannot be too rapidly, if expanded with due regard to the underlying principles of the service. These principles are (1) a recognition of the necessity of efficiently examining workers who are looking for employment, (2) being absolutely impartial and fair, both to worker and employer, (3) never using the service to send workers to an establishment in which a strike exists or is impending, and (4) never to charge a fee.

While in some parts of the country there is a very great shortage of labor, this shortage is more of competency than of actual workers themselves. The Department of Labor is confident that, while it may not always be possible immediately to produce the number of men called for, all that are needed will be found in time to carry out the programme of the Shipping Board. Two or three problems yet remain to be solved. The uneven shipyard wage scales should be scientifically considered and so adjusted that as nearly as possible a common rate shall be fixed, and assented to by all parties concerned, in the ultimate interest both of employer and worker, with due consideration to the rising cost of living. Another important element is the transportation of workers from the interior to the shipyards. Many skilled workers cannot afford to pay their own transportation; there is a question whether they should be expected to do so. If these two problems are solved promptly the Department of Labor has not the slightest doubt that it will be able not merely to supply the needs of the yards, but to build up the permanent force to a point that will enable building of the ships, so far as the supply of labor can contribute toward it, ahead of the present schedules.

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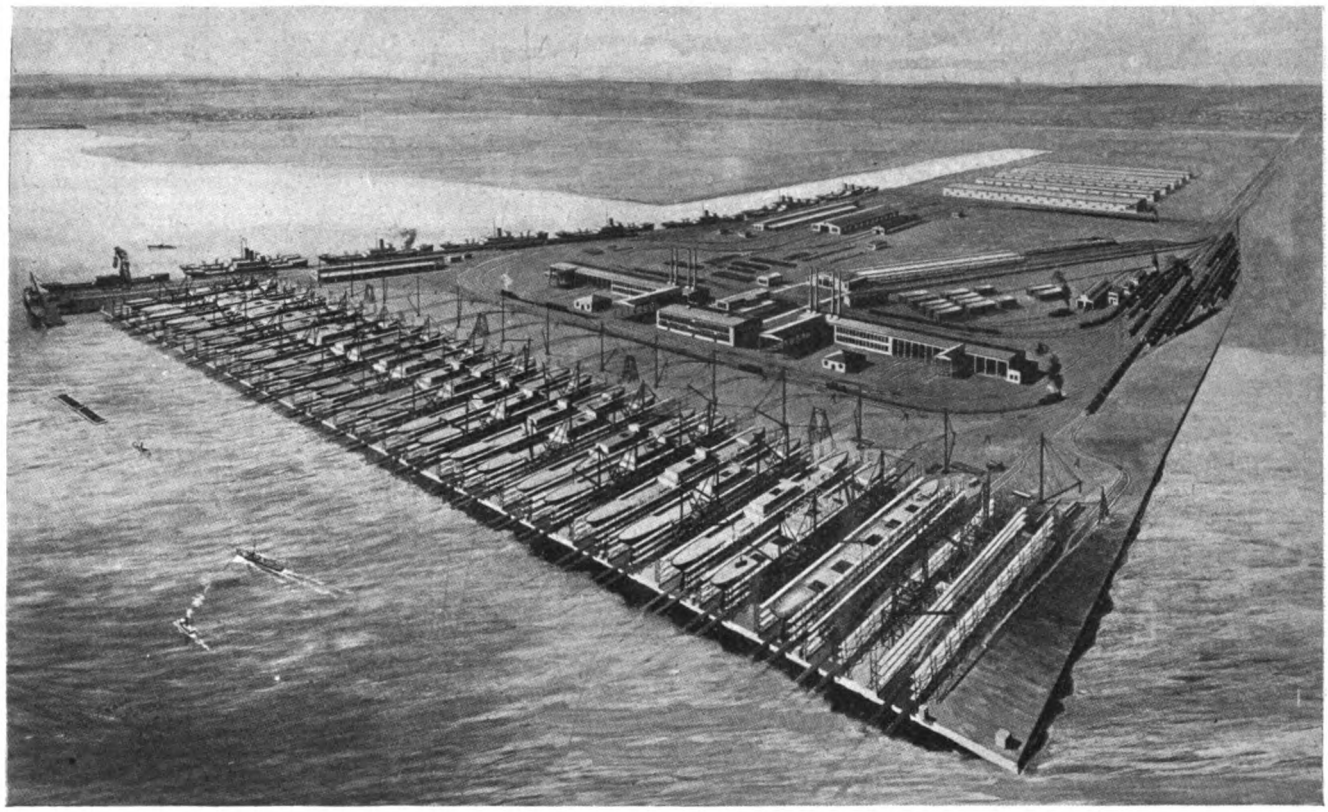

Sketch Showing Birdseye View of Government Fabricated Steel Shipbuilding Plant on Newark Bay

New Government Shipyard on Newark Bay

Plant for Building Fabricated Steel Cargo Ships Planned and Erected by Submarine Boat Corporation

WORK began on the new government plant for building fabricated steel cargo ships on Newark Bay on September 20. The Submarine Boat Corporation, of New York, whose vice-president, H. R. Sutphen, was one of the originators of the fabricated shipbuilding idea, is acting as agent for the Emergency Fleet Corporation both in constructing the yard and in building the vessels. The company now has contracts for fifty cargo boats, each of 5,000 tons deadweight capacity, which will be increased to two hundred ships in the near future.

Thirty different structural steel shops are fabricating the steel for the first fifty vessels, and some of the material for the first vessel has already reached the yard. The first keels will be laid in December, and the first vessels launched in March and completed in May. Each ship requires 1,700 tons of plates and shapes, making a total of 85,000 tons of fabricated steel for the fifty ships now under contract.

Fifteen hundred men are at work on the construction of the plant, and as soon as construction of the vessels begins about 12,000 men will be employed.

Layout of the Yard

The yard occupies an area of 125 acres, and in it will be 15 miles of standard gage railroad track connecting the shops, slips and building ways. These tracks are directly connected with the Pennsylvania and Lehigh railroads and the Central Railroad of New Jersey, so that the fabricated material will be delivered direct to the heads of the shipbuilding ways.

Twenty-eight building ways are being constructed, and although the vessels now on order will be of only 5,000 tons the building ways are being made of sufficient width and strength so that they can be extended later on, if necessary, to accommodate vessels of 9,000 or 10,000 tons deadweight carrying capacity. The building ways are served by fixed leg cranes between the ways and large derricks at the head of the ways. Ample space is reserved at the head of the ways for receiving the fabricated material which will go into the ships.

Back of the storage space at the head of the ways in the center of the property is a two-story main administration building, and on either side of this the ship sheds and fabricating shops. The plant is thus divided into two separate yards, to be known as the north yard and the south yard, each with its fabricating shop, 360 feet long. The buildings are of steel with walls of corrugated iron and glass. On the second story of the main shops is the mold loft.

The Shops

Besides the main administration building and fabricating shops, the buildings now being erected include a restaurant, a terminal building, a hospital, storehouses, paint shops, a main sub-station, transformer station and meter house. All of the machinery will be driven by electricity obtained from the Public Service power plants.

On one side of the property is a slip 700 feet wide, with a depth of water of 20 feet, and a complete wharf 50 feet wide and over 5,000 feet long, which will be used as a fitting out berth. Material will be handled throughout the yard by twenty locomotive cranes of from 15 to 25 tons capacity, with booms 30 feet to 75 feet long.

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Naval Architects' Annual Meeting

Twenty-fifth General Meeting of the Society of Naval Architects and Marine Engineers—Abstracts of Papers Presented

THE twenty-fifth general meeting of the Society of Naval Architects and Marine Engineers was opened in the United Engineering Societies Building, 29 West Thirty-ninth street, New York, on Thursday morning, November 15, with Lieutenant-Commander Stevenson Taylor, U. S. N., president of the society, in the chair. The first business taken up was the reading and approval of the annual report of the secretary-treasurer, which was read by Assistant Naval Constructor A. W. Carmichael, U. S. N., acting secretary.

The report showed the membership of the society on November 1, 1917, to be 875, as against 707 a year ago. Seventy-eight new members were unanimously elected, and other applications for membership presented during the meeting have brought the total membership up to nearly 1,000. According to the treasurer's report, the total resources of the society amount to $32,744.80, and the total liabilities $265, making the society's present worth on October 31, 1917, $32,479.87.

The following deaths were recorded during the year: Members, W. I. Babcock, Charles E. Hyde, George E. Weed; associates, William Conant Church, John R. Raymond, John S. Hyde; junior, Prentiss Lingan.

The following officers were elected for the terms specified:

Vice-presidents (for term expiring 1920).—Dr. W. F. Durand, Rear Admiral W. L. Capps, U. S. N., Rear Admiral D. W. Taylor, U. S. N., Homer L. Ferguson.

Vice-president (for term expiring 1918).—Prof. C. H. Peabody vice G. E. Weed, deceased.

Members of Council (for term expiring 1920).—D. H. Cox, J. W. Powell, W. A. Dobson, Prof. H. C. Sadler, F. L. DuBosque, A. C. Pessano.

Associate Members of Council (for term expiring 1920).—H. L. Aldrich, H. H. Raymond.

Associate Member of Council (for term expiring 1918).—E. M. Bull vice J. S. Hyde, deceased.

Executive Committee (for term expiring 1918).—Lieutenant-Commander Stevenson Taylor, U. S. N., *ex officio;* Rear Admiral W. L. Capps, U. S. N.; Andrew Fletcher, W. M. McFarland, F. L. DuBosque, J. W. Powell, D. H. Cox, *ex officio.*

The president of the society then read his annual address, from which the following extracts are taken.

Abstract of President Taylor's Address

Taken from last year's address, we find the total capacity per annum prior to 1916, of shipyards for building merchant vessels, to have been as follows:

	Registered Tonnage
United Kingdom, Colonies and Canada	1,984,000
United States, including the Great Lakes	540,000
Germany and Austria-Hungary	527,000
All other countries	634,000
Total capacity per annum of the shipyards of the world	3,685,000

Notwithstanding the decrease in merchant shipbuilding in the United Kingdom and Germany caused by the necessities of war, owing to the increase in capacity of United States yards (about 100,000 tons) and elsewhere in the world (about 76,000 tons) the total production of merchant vessels in the shipyards of the world during this year 1917 will be approximately 3,250,000 tons; almost as much as during the banner year of 1913, when there was launched about 3,300,000 registered tons.

But there has been in this country a great change during this same year. In November, 1916, there were about 66 shipyards in the United States, in 27 of which were built wood ships. At this time, November, 1917, there are about 142 shipyards in the United States, 59 of which are building wood vessels, and 4 of which are building composite vessels. With the tremendous programme of the United States Shipping Board, to which must be added the 787 new ships for our navy at a cost of $1,150,400,000 (£236,000,000), from dreadnoughts to submarine chasers—"making the navy the most powerful in the world, second to none," and the necessary additions to our shipyards to accomplish these feats, you may be sure there will be no idle days, but many busy days and nights for several years to come.

It is to be noted that the increase in the number of new wood shipyards is great, but the capacity of same is not nearly so great as the total capacity of the new steel shipyards. Whether, after the completion of the many wood vessels now under contract for delivery in the next two years, there will be any demand for wood ships from these new yards is extremely doubtful, because in normal times there is no question concerning the superiority of the steel ships.

The amount of destruction of vessels by German submarines is uncertain. British authorities give the net loss of British vessels over 1,600 tons, from the commencement of the war to October 31, this year, as 2,500,000 registered tons. Other authorities say that neutral nations, including the United States, have lost about 1,700,000 tons, making a total of 4,200,000 tons, which is probably too low; certainly much lower than claimed by the German government.

It is clear however, that the special efforts of the naval vessels of the Allies have succeeded in keeping within control the destruction by submarines. British authority also states that between 40 and 50 percent of the German submarines operating since the war commenced have been destroyed; but there is apparently no certain knowledge of the number of German submarines under construction.

The announced programme of the United States Shipping Board for a merchant marine at the end of the year 1919 shows a grand total of 14,500,000 deadweight tons capacity, approximately 9,600,000 registered tonnage. This includes all new construction for their Emergency Fleet Corporation; all alien and United States ships under construction and commandeered and the enemy ships that have been seized within our ports.

To bring to a successful conclusion this programme and the successful operation of same as well is a prodigious task requiring all of the energy, enterprise, foresight and earnest activity for which American leaders are noted. That the Board may be assisted in its desired accomplishment, the whole-hearted support of the members of this Society, a unit of men upon whom so much depends, must be given without limit of service or reserve of any sort.

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At the close of the president's address the reading and discussion of papers was begun, the first paper being read by the acting secretary on account of the absence of the author.

The Service Department of a Shipyard

BY SAMUEL W. WAKEMAN

ABSTRACT

The author describes the functions of the Service Department of the Fore River Shipbuilding Corporation, established as a result of an investigation made about two years ago at a number of the leading manufacturing concerns in the United States by a committee of workmen, foremen and others from the yard. In accordance with the recommendations of this committee, a brick building was erected near the main gates of the plant to take care of the hospital work, the employment department and general activities relating to the physical, mental and social condition of the employees.

The scope of the activities of the service department resolve themselves into the following: Employment, hospital, safety work, educational work, apprentices, employees' club, workers' paper, suggestion committee, work yard restaurant and shop training. The *personnel* of the service department consists of the following: Supervisor, assistant, clerks, stenographer, supervisor of instructors, instructors, employment agent, employment clerk, doorman, doctors, nurses and messenger boys for conducting applicants to the shops.

Daily reports are prepared by the employment department showing the number of men hired and leaving by trades; also the daily gain or loss in the working force. Monthly reports are also made of the turn-over of labor, including the number of men hired and leaving by trades, and showing the length of service and reasons for the man leaving. Before this plan was in operation, in order to maintain a force of about 4,000 employees, it was found necessary to hire in the course of a year 8,000 men. During the last six months the present force has been increased from 4,000 to 8,000, and this has been done by hiring only 9,000 men.

It is not claimed that any new or radical ideas have been adopted in connection with the handling of this situation, but what has been done is to find out what successful concerns in other lines of work have done, and to combine them together in such a way that they might be adapted to the work of a shipyard.

DISCUSSION

Naval Constructor T. G. Roberts, U. S. N., pointed out that industrial betterment (or industrial service), formerly known as welfare work, is now being extended to all shipyards through the Shipping Board by Myer Bloomfield, head of the Industrial Service Department of the Emergency Fleet Corporation. One of the most important questions facing a service department is the source of labor. At the Fore River shipyard the service department was placed in touch with a great number of sources of labor through Federal, municipal and various employment agencies very successfully. Naval Constructor Roberts pointed out, however, that the human element is the largest element in management, much depending upon the enthusiasm, happiness and welfare of the workmen.

Rear Admiral R. M. Watt, U. S. N., emphasized the necessity and value of arousing enthusiasm among the employees, and commented favorably on the pamphlets described in the paper which are used at the Fore River yard to acquaint new employees with the details of the plant and its organization. He also called attention to the value of the policy described on page 5 of the paper, whereby foremen of departments recommend discharged men for service in other departments where they may be better adapted to the work.

Shipbuilding in the Gulf States and the Natural Resources and Facilities Favorable Thereto

BY CHARLES N. CROWELL

ABSTRACT

The yellow pine timber supply of the South is furnished principally from the States of Mississippi, Louisiana and Texas. This supply, close at hand to the builder in the Gulf States, gives the advantage of quick delivery and low freight rates, which makes the South and Gulf States especially well adapted for wood shipbuilding.

The facilities for building steel ships are also available. In East Texas, in the region adjacent to Beaumont, there are very extensive areas of iron ore. Plans are already being formed to develop this ore and will probably be put in shape in the near future. Smelters and rolling mills and fabricating plants will be established, and steel ships will be a product of the South. As it is now, several contractors are considering the importation of fabricated steel with which to build steel and composite ships. This supply would come from Birmingham, Memphis and St. Louis. The important factor, fuel oil, is found all through Texas and Louisiana.

Shipbuilding plants have sprung up all over the South; many there are which six months ago were covered with forest growth. Many of these plants to-day are well equipped, containing all modern labor-saving machinery and, in the district lying west of the Mississippi River, at least 150 vessels are building and contracted for. Some of the men who are operating the various new shipyards have never built vessels, but, what is more important, they are men of executive ability, who know how to make up an efficient organization.

The South not only has the material supply, but she has it close at hand; already many building plants are well established and there are available sites for many more. Any kind of a ship and any integral part of a ship may be produced in this southern country. In these days of improved woodworking machinery the skill of the shipwright, once the autocrat of his trade, is largely supplemented and compressed air now does most of the work of fastening, which forms a large percentage of shipyard work. Another advantage of this southern country is the small percentage of time lost, due to the favorable climate in both winter and summer.

Progress of Marine Engineering and the Education of the Marine Engineer

BY ROBERT HAIG

ABSTRACT

The dominating thought in presenting this paper is the hope that this influential body and other kindred societies will impress upon the proper governmental department the urgent demand in this country to-day for trained marine engineers.

In no other country is there such an abundance of well-educated material to draw from to produce highly trained marine engineers, and in none of the other maritime nations is there such an absence of effort on the part of the State to provide the means to train and develop men

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engaged in marine engine shops to fit them to take charge of important machinery on ships.

The responsibilities of the seagoing engineer differ widely from those of the land engineer, as the former, once he has left port, is entirely dependent upon his own resources; he and his staff must possess the capacity, unaided, to carry on their duties in face of all difficulties until they can reach another port.

In view of these facts, it is imperative that engineers should be given such experience and training that they can with confidence and ability meet any and all conditions that may arise.

When we consider that the estimated increase in American merchant tonnage in the next three years will be upwards of ten million tons, equal to 1,000 ships of 10,000 tons deadweight, calling for about 5,000 extra marine engineers, we get some idea of the demand that is bound to arise for trained enginers, and the necessity will be imperative that these men should have experienced training, as many of these vessels will have watertube boilers, geared turbines, electric power, refrigeration, etc. All these things will demand experienced care and attention, and without the necessary care and attention we will have vexatious delays and enormously increased cost of operation, and, what is of paramount importance to the nation, we will have a very much lowered transportation efficiency.

The resourcefulness of the engineer at sea is something we are proud of, but day by day his responsibilities are becoming greater, and he should be given the greater opportunity by special facilities of physical and educational training, provided by the Federal Government, to rise in his profession and widen his sphere of usefulness.

The Effect of Wind and Fouling Resistances on the U. S. S. Neptune

BY W. W. SMITH

ABSTRACT

This paper gives the results of a number of observations and experiments to determine the effect of wind and fouling on the resistance of the U. S. S. *Neptune*. During several trials and voyages observations were made in light and heavy winds, other conditions remaining the same, and the effect of the wind determined therefrom. The results obtained are given in the tables, in which the comparisons are based on both speed of vessel and revolutions per minute. Similar data are given for the battleship *New York* and the destroyer *McDougal*, from which it is seen that the effect of wind on the *Neptune* is very much larger than on vessels of ordinary design.

Experiments were also made on the *Neptune's* model in the wind tunnel at the Washington Navy Yard to determine the resistance of the vessel. The resistance as found by the model experiment was about half of that determined by observation. A small part of the difference may be due to errors in estimating the wind velocity, but still there would remain a considerable difference unaccounted for. Even with the experimental values, the *Neptune's* wind resistance would still be very large in comparison with ordinary vessels.

The action of wind on flat surfaces is treated theoretically and formulæ are derived for determining the wind resistance and power of vessels from observations as given in the paper. Diagrams for the relative wind velocities and forces in the several directions required and for all conditions are given in convenient form for reference.

The effect of wind and fouling resistances on the results of standardization and sea trials is discussed and the large possible variation from the standard or designed resistance due to unfavorable conditions of wind and fouling is pointed out, together with the undesirability of departing materially from the standard in both respects.

THURSDAY AFTERNOON SESSION

Recent Development in Tank Steamer Construction

BY ROBERT W. MORRELL, M. E.

ABSTRACT

The author shows that during the recent period of activity in shipbuilding in the United States the number of tank ships has increased 112 percent, the gross tonnage 185 percent and the total deadweight tonnage 185 percent. The total number of American tankers now in service is about 170, having a total gross tonnage of 823,200 and a total deadweight carrying capacity of 1,180,000 tons, which is close to 20 percent of the total steel American tonnage, exclusive of the Lakes, as against 10 percent at the beginning of 1915. In addition, there are now under construction in the United States a total of 64 tank vessels, representing 496,680 gross tons and 575,750 tons deadweight, marking the greatest shipbuilding activity in the history of the country.

The most impressive feature of the modern tanker is the size, the average deadweight previous to 1915 being 5,200 tons, while at present it is 9,100 tons. Along with the increased size has come the development of the shelter deck type of vessel, and more recently the carrying of the expansion trunks right up to the shelter deck, the advantages of which are numerous in spite of the fact that additional steel is required and the scantlings must be increased on account of the increased head of oil. The shelter deck vessel permits carrying an increased deadweight on a limited draft without adopting extreme proportions, as well as giving greater strength structurally.

The growing tendency is also noted of adopting a straight sheer line amidships. As far as the construction of tankers is concerned, two features are of special importance; one, the adoption of the rolled tee-bar section for oil-tight work, and the use of the multiple punch.

In view of the large number of tankers recently sunk by submarines, the author discusses the question of ballasting in order to give the most favorable conditions if the vessel is torpedoed. After carefully considering the subject, the writer's conclusions are:

First.—That no slack tanks should be carried, thereby eliminating the danger from listing.

Second.—That the vessel be given as much reserve buoyancy as possible, which may be the means of saving the ship if torpedoed in the machinery space. Therefore, as little ballast should be carried as weather conditions will permit, but whatever is carried should be in full tanks so distributed as to equalize the loading to the best advantage.

Third.—That gate valves be fitted in the centerline bulkhead near the bottom of each tank operated from the deck, but left open at sea; thus, if empty tanks are pierced, the water will equalize and prevent listing.

Considering the subject of standardizing tankers, the author notes that the sixty-four tank vessels now under construction in American yards represent nineteen distinct types or designs and are being built in sixteen different shipyards for sixteen different owners. The nineteen types range in size from 5,000 to 15,000 tons deadweight and represent almost every possible variation in design. As these vessels were designed by competent men to meet specific requirements and as special vessels are required for special trades in order to obtain the best results it is obviously impossible to design a single vessel to meet

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all requirements, and, if an attempt at a compromise is made, it will place practically every oil company at a disadvantage in having to operate vessels which are not quite suitable. The nearest approach to efficient standardization, the author concludes, would be in the adoption of at least four standard designs consisting of two vessels—a large one and a small one—for the sole purpose of carrying cargoes of heavy oil, and two vessels—a large one and a small one—especially for carrying mixed cargoes of light oil.

At the present time the United States Shipping Board has made no provision for tankers in its shipbuilding programme, and, as all of the vessels now under construction are for 1917 or 1918 delivery, when these vessels are completed the building of tank ships will, according to present indications, be at a standstill in this country. That the Shipping Board has made a grave mistake in entirely ignoring one of the most important of the Allies' necessities and one of our own principal industries, by excluding tankers from its programme is only too evident because the demand for tank steamer tonnage is greater than ever, and new vessels will be needed constantly to meet the ever-growing transportation requirements. Not only is the Shipping Board refusing to place new orders for building tank ships, but it will not permit anyone else to do so. This policy can have but one result, and, if immediate steps are not taken, we shall unquestionably be faced by a grave shortage of tank steamer tonnage. This condition is most serious and urgent and demands the earnest consideration of all shipping men having the nation's welfare and the cause in the great struggle which it represents at heart.

Power and Economy Test of the S. S. Pontiac

BY A. GEORGE MATTSSON AND THOMAS DURKIN

ABSTRACT

The paper gives a description and trial data of the S. S. *Pontiac,* built by the Great Lakes Engineering Works, Detroit, Mich. The vessel is a bulk freighter 600 feet overall, 580 feet keel, 60 feet beam and 32 feet deep, constructed on the arched girder and transverse frame system with straight hopper sides 6 feet deep from the skin of the ship extending up to the main deck stringer. She is a duplicate of a dozen or more ships built on the Lakes during the past two seasons, and is considered the most practical, as well as the most profitable, carrier in the iron ore trade now on the Great Lakes.

The ship is of the single-deck type, having a main deck at the end only with her cargo space free from any obstruction whatsoever. Propulsion is by a triple-expansion engine placed aft, with cylinders 24½ inches, 40 inches and 65 inches diameter by 42 inches stroke, supplied with steam by three single-ended, two-furnace Scotch boilers working under the improved Great Lakes Engineering Works' system of heated positive draft and having a total of 6,405 square feet heating surface and 137¼ square feet grate area.

The trial run covered a distance of 225 statute miles on Lake Huron at full speed with full cargo. A speed of 10.875 knots was obtained with an indicated horsepower of 2,441. The coal consumed per indicated horsepower per hour was 1.34 pounds.

Devices for Comparing the Rotation of Shafts

BY DR. K. SUYEHIRO

ABSTRACT

This paper describes an apparatus designed to show comparative speeds and also the relative phases of two shafts which are to be connected together while running by a clutch or other means. The construction of the apparatus involves the principle of a rotating cinematograph. The apparatus was devised by Mr. Tsuchiya, of the Kawasaki Shipyard, Japan, and the author conjointly and has been used in many cases, giving satisfactory results.

FRIDAY MORNING SESSION

Cargo Ship Lines of Simple Form

BY NAVAL CONSTRUCTOR WILLIAM MC ENTEE, U. S. N.

This paper will be published in full in the January issue.

DISCUSSION

Prof. H. C. Sadler outlined experiments made at the University of Michigan in which further simplification of the straight line model was accomplished by doing away with the round bilge, tests being made with models whose sections consisted of straight lines with sharp corners, and also similar sections with the corners cut off by straight lines. Models of this form showed less resistance than the conventional ship models. No difference was found between the ship-shape form and those with the straight-lined sections with the corners cut off except above speeds ordinary in such vessels. The only difference detected between the sharp corner model and those with the corners cut off on a straight line was about 2 to 5 percent up to high speeds. Professor Sadler held that securing the proper slope of the flat bilges is the main question. The sea-going qualities of such a type of vessel have proved satisfactory and the structural features allow simplification in construction. Contracts have been given by the United States Shipping Board for vessels of this type, and the designs have been approved by the American Bureau of Shipping and Lloyd's Register of Shipping.

Naval Constructor McEntee held the opinion that the U-sections forward, as shown in his paper, give better sea-going qualities than the fine forefoot of the models described by Professor Sadler.

Application of Electricity to Various Auxiliaries on Shipboard

BY H. L. HIBBARD

ABSTRACT

In the use of electricity the American Navy has not only been far in advance of the merchant marine, but has led all navies of the world. Europe, however, seems to have led this country in the trial of electrical apparatus for auxiliaries on merchant vessels.

Among the most striking examples of the use of electricity on merchant vessels are the boats being constructed and projected by the Pennsylvania Shipbuilding Company at Gloucester City, N. J. This company has under construction six tank steamers of about 7,500 tons displacement, one of which is nearly completed and another will take the water shortly, which will be propelled by geared steam turbines and their auxiliaries operated by electricity throughout.

In addition to the above tankers, two cargo vessels of 12,000 tons displacement will soon be laid down and which will have an equipment of auxiliary motors similar to the above tank vessels with the exception of the deck winches, which will consist of three of 25 horsepower and eight of 15 horsepower. It is further contemplated that these two cargo vessels will be electrically propelled and operated by two turbo generating sets, each set furnishing current to a 1,500-horsepower motor, the two motors being geared to the single propeller shaft.

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In addition to these vessels, this company contemplates the construction also of six cargo boats propelled by geared steam turbines and with electrical auxiliaries similar to the above.

For the above vessels open-type alternating-current motors will be provided throughout and watertight enclosing cases furnished for the deck motors, with the particular view to protecting them from exposure to moisture; but the cases can be removed, if desired, when the vessels are in port, to give the motors ample ventilation.

In contrast to the alternating current used on the above vessels, the Texas Oil Company is soon to construct a tank vessel of approximately 6,000 tons displacement, propelled by fuel oil engines and provided with direct-current, 230-volt motors on its auxiliaries.

While it is not here the intention to discuss in detail the relative merits of various kinds of motors, it may be mentioned that in comparing the direct-current with the alternating-current equipments mentioned above, a saving in wiring, flexibility of speed control, and improved speed and torque characteristic for the deck auxiliaries are on the side of the direct-current equipments. The alternating-current motor, as pointed out above, has the advantage of freedom from moving contacts and the reduction, in consequence, to a minimum of the possibility of sparks in places where inflammable gases might be encountered, as in the case of the tank steamers. This, however, applies particularly to the constant speed, squirrel-cage type of alternating-current motors, the slip-ring type of motor, which is required for some applications being provided with moving contacts.

In connection with the electric propulsion of ships it is interesting to note that, in addition to the very considerable number of electrically propelled ships now being constructed for the navy, this mode of propulsion is receiving considerable attention in its application to merchant vessels. In addition to the two cargo vessels at the Pennsylvania Shipbuilding Company's plant, which it is expected to propel electrically, we are familiar with electrical installations on four oil barges under construction at New Orleans by the Petroleum Transport Company. These boats are twin screw, each propeller being driven by a 300-horsepower, 480-volt, 3-phase, 60-cycle motor, the two motors being operated by one turbo generating set of similar voltage and frequency.

We have thus seen some of the progress which has been made in this application of power in the merchant field, and we feel certain that its application by this time would have been considerably more extended had not the war conditions necessitated, at least in the opinion of the Government officials, foregoing consideration of electrical apparatus in favor of steam in order to produce a merchant fleet in the shortest possible time.

In addition to the advantages which have been considered and resulted from electrical installations on naval vessels, numerous specific advantages are apparent in connection with such installations in the merchant marine, including frequently a saving in space and weight in the installation of the auxiliaries themselves, a very much higher efficiency of operation, and consequent saving in total fuel consumption, the elimination of long and objectional lines of steam piping, which on certain classes of cargo vessels are nearly always installed above deck and result in continual steam condensation; also, on certain of the auxiliaries, particularly those requiring varying speed and load conditions, the electric motor offers some distinct advantages over the use of the steam engine.

Submarine Hulls—Comments on Various Types

BY NAVAL CONSTRUCTOR E. S. LAND, U. S. N.

ABSTRACT

In this paper the author analyzes as far as practicable the merits and demerits of the single and double-hull types of submarine, disregarding entirely the intermediate types. The features compared include deck space and freeboard, strength, form as affecting surface speed and seaworthiness, fuel tanks, sea-keeping qualities, armament, buoyancy, safety in case of collision and sumberged resistance.

The disadvantages of the double-hull type are summarized as follows: (a) The hull tanks are weaker than the spindle hull, and it would be dangerous to pump tanks when deeply submerged. (b) A very large metacentric height is necessary in the light condition in order to obtain a safe metacentric height while submerging and when submerged, otherwise the stability approaches zero when trimming down. (c) A large metacentric height will probably give a safe boat whose surface activities in a seaway will resemble those of a destroyer. This may be relieved by bilge keels. (d) In a double-hull type, the benefit of the free ballast water is more profound than in the single-hull type, because in the former the weight and moment of the ballast water are larger than in the latter.

The advantages of the single-hull type are summarized as follows: Simplicity of construction, lighter weight and less time to fill tanks.

If the size of the type is considered, the author points out there will come a dividing line beyond which the double-hull type has many important advantages over the single hull. As regards this point, he says there can be little question but that for boats up to 600 tons surface displacement the advantages of single hull predominate. From 600 tons to 800 tons there is little to choose from, but beyond 700 tons it appears that the double-hull boat has the call, and when greater displacement than 800 tons is considered the advantages of double-hull boats for work with the fleet greatly outweigh the advantages of the single-hull type. There appears to be little to choose from in the two types when it comes to the question of stability. In the single-hull type we find a small surface metacentric height and a considerably larger submerged metacentric height. In double hulls, on the contrary, we find a large surface metacentric height and a comparatively small submerged metacentric height. With more recent types, where displacements are around the 800-ton mark, it is becoming increasingly difficult to equip a single-hull boat with the armament and equipment desired and yet retain the requisite surface stability.

As to the future development in submarines, the author points out that the 1918 programme calls for nothing but the 800-ton type, which is believed to be a great step in advance. Submarines of 2,000, 3,000 and 5,000 tons have been projected in foreign navies, and some of them are actually in existence, but the author ventures the prediction that the great preponderance of submarine construction going on to-day in the great navies of the world is in the vicinity of the 800-ton type, which he believes is the most useful all-the-year-round type of submarine.

FRIDAY AFTERNOON SESSION

At the opening of the afternoon session, Henry A. Magoun, vice-president of the New York Shipbuilding Corporation, presented the following resolution, which was unanimously adopted.

"Having in view the trying period through which our country is going, and the vital necessity of hearty patri-

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otic co-operation by every class in the community, and,

"Having in view the intimate relations of employer and employee between the members of this society, therefore

"*Be it resolved,* That it is the sense of this meeting that the Council be asked to formulate suitable resolutions to the President of the United States assuring him of our loyal support in every way, and especially endorsing his earnest efforts to arouse the patriotic enthusiasm of labor, organized and unorganized, to put forth every effort to insure the victory of our arms."

Fabricated Ships

BY R. H. M. ROBINSON

This paper is published on page 549.

DISCUSSION

Prof. H. C. Sadler, while admitting that it is possible to speed up the manufacture of parts that go into a ship by utilizing manufacturing processes, declared that there remains the question of putting the parts together, and especially the operation of riveting. The problem which must be faced is the delivery of the goods on the other side of the Atlantic. Vessels must not be delayed by faulty riveting or failure of machinery. In other words, we must build superior ships, not vessels hastily put together.

The Influence of the War on Submarine Policy

BY MARLEY F. HAY

ABSTRACT

It is not at all clear that before the war any of the Allied Powers, or for that matter the Central Powers, seriously anticipated or contemplated the possibility of ruthless submarine tactics against merchant shipping as at present employed by Germany. That it was not a predetermined policy before the outbreak of war appears to be evidenced by the fact of Germany's complete unpreparedness at that time to conduct submarine warfare, coupled with the further fact that the design of the earlier German submarines indicated the intention of anti-warship rather than anti-merchantman tactics.

The experience of the war has taught submarine officers to make the most of the virtue of invisibility; showing more than the top of a periscope during the twenty hours of daylight in the summer months is an undue risk not to be taken without sufficient reason. The energy of the battery must be conserved, however, to be available when needed in an emergency. To that end arrangements have been perfected to facilitate what is variously known as balancing, statical diving or suspending. With a minimum expenditure of power, the vessel remains stationary in the submerged condition with only the tops of the fully extended periscopes exposed. With the sensitive listening devices now extant it is of vital importance that this mechanism be as nearly noiseless as possible and that no air bubbles escape to betray the presence of the boat.

During the first years of the war little success was experienced in combating submarines with submarines, principally for the reason that their reciprocal invisibility militated against their finding each other except when one was on the surface. Later developments in submarine signaling and sound-detecting devices have made it possible, however, to hear a submarine even when it cannot be seen, and also to approximate its direction. Proceeding in the direction whence the sound came, an effort would be made to locate the enemy's periscopes and get within torpedo range. Any submarines now in commission provided with the latest listening plates could perform the function of a submarine patrol with a certain degree of success, but it is evident that a submarine designed especially for this kind of work, in short a contra-submarine, would logically depart considerably from the characteristics of submarines proper as we now know them. While it is possible to make a compromise design combining the essential characteristics of the submarine-versus-warship type with the submarine-versus-submarine type, such a compromise is not compatible with the highest requirements of either and is likely to entail the weak points of both and the pre-eminent advantages of neither. For that reason two distinct and separate types are to be preferred.

The contra-submarine will do practically all of her work submerged. Therefore, the displacement should be sufficient to ensure satisfactory habitability, and a very powerful battery and large motor should be installed to give the maximum possible endurance submerged and the highest submerged speed at the maximum discharge rate of the battery. On the other hand, battery efficiency expressed in output per pound of weight is highest when the individual cells are not too large, especially when the vertical measurement is at a minimum; nor is it desirable to unduly increase the voltage. Hence practical limitations are imposed which will possibly determine 500 to 600 tons as a satisfactory surface displacement. Facility of maneuvering submerged also inhibits too great a displacement.

Everything that contributes to resistance submerged should be examined critically with a view to reduction or elimination.

As for armament, torpedoes, say, of 12-inch diameter, would be preferable. As many tubes as possible should be grouped for simultaneous firing, arranged at slightly divergent angles, with torpedoes set for various depths, so that dispersed fire is obtained on the principle of a shotgun.

DISCUSSION

Simon Lake endorsed the statement made by Mr. Holland years ago that it is impossible to fight a submarine with a submarine. He believed, however, that the submarine is the antidote of the submarine, not by hunting it, but by evading it, and favored the building of merchant submarines, exhibiting plans for 5,000-ton and 7,500-ton boats of this type.

Mr. Hay pointed out that the German merchant submarine *Deutschland* was capable of carrying only 20 percent of its displacement and expressed the belief that the large merchant submarine is a hopeless project.

An Analysis of the Principles of Industrial Management

BY NAVAL CONSTRUCTOR T. G. ROBERTS, U. S. NAVY

ABSTRACT

Originally, the purpose of the author was to reach a conclusion as to the wisdom of installing the Taylor system in the navy yards; and the years 1911-1912 were devoted to an investigation of the various phases of the question, the conclusion having been reached in 1913 that many of the claims were justified, but that the Taylor system, as a whole, was not suitable for application throughout a navy yard; and this view was communicated at the time, and it is hoped with some effect, in that connection.

The paper which the author has written, covering over one hundred pages and divided into some eighteen chapters, is an exhaustive treatise of the subject. The first chapter attempts to evaluate the Taylor system in popular style by exposing the underlying principles and showing that it comprised a particular combination of elements, most of which were derived from the best practices de-

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veloped in industrial management generally and combined with a few new elements devised by Mr. Taylor. The essence of the Taylor system was the premium and the time study, which he called the "arch" and the "keystone," respectively. The labor organizations aimed straight at the arch and the keystone, and have finally succeeded in causing laws to be passed forbidding the use of those mechanisms in Government work.

The next chapter deals with the question of the tool, and shows how Mr. Taylor built up a system of auxiliary services around the point of the tool, so as to remove the greatest amount of material in the least possible time by a tool operating continuously between clock-strike and clock-strike. The problem resolved itself into determining the proper speed, feed and depth of cut to adopt in order to remove the greatest quantity of material in the shortest time. The next chapter deals with the machine carrying the tool and of perfecting it so that it would drive the tool at the desired speed, feed and depth of cut, while the following chapter deals with the question of the belt, as a veritable little branch of scientific management was necessary in order to tighten, adjust, renew and care for leather belting outside of the regular working hours, so that it would not break or slide off or operate under inefficient tension during working hours. The succeeding chapter deals with the question of the man and the auxiliary services necessary to supply him with tools, jobs, materials, supplies and instructions, so as to keep him operating continuously without loss of time between jobs.

The next chapter describes Mr. Taylor's functional foremanship, the great principle of which has been understood and adopted in modern industry, especially in the great shipyards in the employment of a far greater number of superintendents, foremen, quartermen and leading men than ever before, and these, under some name or other, nowadays perform the same work in substance as that outlined under the functional foreman.

The next chapter illustrates time study and explains its constituent parts, distinguishing between time study and motion study, and pointing out the best example in motion study available—that of the case of bricklaying as developed by Mr. Frank B. Gilbreth.

The next chapter explains the bonus and the premium as synonymous terms, and distinguishes between day work, on the one extreme, and piecework on the other; where in the former case the management reaps all the benefits in case of increased production and the workman, in the case of the latter. The various wage systems that have been invented are set forth and illustrated and fall somewhere between the two extremes of day work and piecework.

The psychology of management is dealt with in the next chapter, showing that efficiency engineers have adopted the correct lines by taking advantage of a man's nervous system as an ally, instead of an enemy. The considerations of the mind and the reactions of the body are fully discussed as affected by motion study, bonus, repeat work, functional performance of work, division of labor and specialization.

From the psychological viewpoint, time study and bonus are in keeping with political economy and great benefits to employees, employer and society at large. A discussion of political economy in management follows, showing the falacy of the policies of organized labor in their fear and hatred of overproduction. Various examples are given showing that specialization, on the whole, has produced greater efficiency and a greater number of products and greater emoluments, comparatively speaking, than in former times, when varied production was the rule.

The succeeding chapter is devoted to Mr. Taylor's work, "On the Art of Cutting Metals," in which is brought out tersely and clearly the various and wonderful developments in the application of modern tool steel.

The next chapter deals with the so-called Emerson system, and shows that it is practically the same as the Taylor system, by the substitution of different names, so far as the machine shop is concerned. Mr. Emerson's system, however, goes beyond the shop and deals with compound management, involving many shops. The author discusses the installation of modern, efficient management in an inefficient plant, and points out the way in which it can be best and quickest done. The Vickers system, from the British shipyard of that name, which the Navy Department said it would introduce in some of the navy yards a few years ago, is taken up next. It is shown that the essence of the Vickers system consisted of the time study and the bonus, and that these can be traced back to Mr. Taylor at the Bethlehem Works. The following chapter deals with various other considerations affecting shop management in general, including the committee, or board, system of Mr. Charles U. Carpenter as practiced in establishments in general, and in one great shipyard in particular. This is followed by a chapter dealing with organization, and a chapter devoted to cost accounting, in which that work is held to be the function of the engineer and the supplying and the administration of the vehicle is the function of the cost accountant or bookkeeper, whose operations are subject to be determined by the engineer.

The succeeding chapter deals with welfare work, in which are elaborated a great number of elements which have been introduced in modern industry, while the final chapter is devoted to the shipyard of to-day, contrasting the shipyard of disorder and dirt of the past with the improved yard of the present. The example of the Fore River shipyard is cited in particular, and others in general. The detailed workings of the "safety first" movement, the committee system and the welfare movement are shown, as applied to shipyards. The application of the various wage systems has been set forth. A practical machine rate system of accounting is exhibited for a machine shop, and the question of cost and overhead charges is exhibited in connection with the policy when in past years "depreciation" has been neglected as an element of cost—but not so now, under the "cost plus" contracts for the Government, where the shipyards have not remained behind the times.

In conclusion, the author points out that while the shipyards have improved greatly in recent years, nevertheless shipbuilders will, no doubt, be willing to admit that there is still room for much improvement.

Gyro-Ship Stabilizers in Service

BY ELMER A. SPERRY

ABSTRACT

Several interesting and successful installations of gyro stabilizers in commercial, pleasure and naval vessels for the prevention of rolling are illustrated and described in this paper. The stabilizing equipment, considered in the light of the results accomplished, is insignificant in points of size and weight, usually weighing not far from one percent of the displacement even for large ships and costing per pound not far from other mechanical equipment on shipboard. The advantages gained include not only the effective suppression of rolling but in a seaway a dryer ship and for the same number of propeller revolutions the same speed as in still water, together with a reduction of stresses in the hull due to the action of the waves and the unlooked-for advantage that the stabilized ship holds her course remarkably in a heavy sea with little or no helm.

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Letters from Marine Engineers

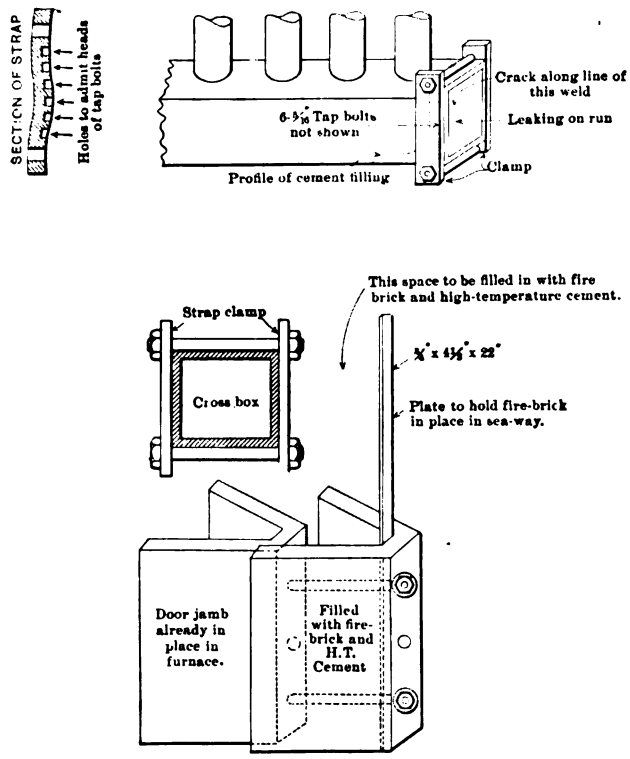
Discussion of the Design and Handling of Marine Engines, Boilers and Auxiliaries—Breakdowns at Sea and Repairs

This department is open to all readers of the magazine for the discussion of affairs in the engine room. All letters published are paid for at regular rates. Your ideas or experiences will be mutually helpful and interesting to other engineers. Write your letter now.

Repairs to Leaky Cross Box in Babcock & Wilcox Boiler

The following incident regarding repairs to a Babcock & Wilcox marine boiler is submitted in the hope that it may prove of interest:

While under way from ..... to ..... a distance of 1,800 miles, the main boiler of the ..... (B. & W. marine type) developed a leak in the port cross box at the weld on the inboard end, the defective section of this weld extending a distance of 4 inches, much water and steam coming through the crack. A distance of 1,500


SECTION OF STRAP
Holes to admit heads of tap bolts
6-5/16 Tap bolts not shown
Crack along line of this weld
Leaking on run
Clamp
Profile of cement filling
This space to be filled in with fire brick and high-temperature cement.
Strap clamp
Cross box
5/8" x 4 1/2" x 22"
Plate to hold fire-brick in place in sea-way.
Door jamb already in place in furnace.
Filled with fire-brick and H.T. Cement

Repair to Defective Cross Box of B. & W. Boiler

miles remaining to complete the run and the vessel having but one boiler, it was necessary to continue the run and make up the extra feed required by the use of the evaporator, weather conditions at the time forbidding making repairs at sea.

Upon arrival at ....., the end of the run, the boiler was blown down and inspected, and it was found that the leak in the port cross box was in a vertical crack in the after side of the inboard end of the box in line with the weld between the metal of the cross box and the ¾-inch plate plug which closes the end of the box.

The repairs made consisted of the following:

Drilled and tapped six 5/16-inch holes through the metal of the cross box and into the plug about ⅝ inch. Red lead was forced into the crack (by means of a red lead gun) and tap bolts screwed hard up in these holes to close the crack. Also made and fitted a double strap clamp of ¾-inch plate about 4 inches wide and of a suitable length, set up with ¾-inch bolts in the manner shown in the sketch. The strap fitted on the after side of the cross box was convexed so as to put the strain over the crack; holes were partially drilled in the bearing surface of the after strap to admit the heads of the six tap bolts, and then filled the end of the box with Portland cement, sloping gradually back a distance of 5 or 6 inches. Care was taken when placing the cement to insure circulation for the nearest nipple and space for its replacement if necessary.

The repairs were protected from the heat of the fire by making use of a guard consisting of a door jamb, fire-brick and high temperature cement, the door jamb guard being secured to the door jamb already in place in the furnace, as shown in the sketch.

After completing the repairs they were tested under 160 pounds hydrostatic pressure (the allowed working steam pressure on the boiler being 110 pounds) and no leaks were visible.

The repairs to the cross box have now held without any leaks for a period of three months, the vessel cruising continually, and the repairs are not affected by the heat of the fire as long as the guard is maintained in efficient condition. The life of the guard is about one month, when it is then necessary to renew same. The renewing of the guard is a simple matter and is done while the boiler is under steam, the fires being hauled temporarily.

It was not possible at the time repairs were being made to obtain the use of a welding outfit. J. F. H.

Condenser Notes—Partial Loss of Vacuum —Leaky Tubes

There are numerous causes for partial loss of vacuum, chief of which are the leaks of air into the system. The low pressure valve and piston rod stuffing boxes of the main engine will be found the most troublesome of all the sources of air leakage. Leaks around these and other packing glands can be detected readily by holding close to them a flame. (A good torch for seeking out leaks is made from a pine stick dipped in alcohol and then lighted.) This will be sucked in, thus showing the leakage of air into the condenser, which will partially destroy the vacuum.

When the vacuum drops suddenly, or to any great amount, all the valves of branch exhaust lines leading to pumps and machinery should be examined, for if they be open when the machinery is not in use it multiplies the number of chances for air getting in. Sometimes a piece of auxiliary machinery is undergoing repairs, the cylinder or valve chest is open, and the machinist has neglected to secure the exhaust valve, or it may be leaky—all such points must be carefully watched when vacuum is poor and troublesome.

When the stuffing boxes and valve lines and joints are O. K., then the valves of the air pumps may be to blame

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for low vacuum. These valves should be a free fit, lift easily on the studs, and be of sufficient width to cover the seat opening adequately. They should be light rolled bronze material. Generally three separate disks are used, of varying diameters, to make up one complete valve. (The springs of the bucket and suction valves should be light and durable, having only enough tension to insure seating of the disk.) It must be understood that when stiff springs are used, it will be necessary to have a higher vacuum in the pump cylinder to lift them; this necessitates increased speed of the pump.

The valve disks, springs and studs can be examined to see if they are intact by removing the handhole plates fitted in the pump barrels and discharge chests, ofttimes due to the collection of grease and sediment into small lumps and balls.

Some of these valves will be found to be partially raised off their seats. These, of course, must be cleaned and seated. Worn, twisted or warped valves are also causes for poor vacuum. In replacing the handhole covers, be sure to get them into their original position, for a part of the cylinder wall is formed by their inner surface.

When the air pump and all parts of the system are found to be in good order, there are still a few other traceable causes for defective vacuum. The suction of the air pump may be too warm. Generally, when this trouble is found, it is caused by insufficient supply of circulating water, or fouled tube surfaces, but it may be that the condenser is temporarily overloaded and lacks sufficient cooling surface. This seldom is the cause with large condensers, but is frequently found to be the trouble with the smaller auxiliary ones, when too much machinery is allowed to exhaust into them.

Lack of circulating water may be due to slow speed of the pump, choking of the intake by marine matter, grass, etc., plugging and fouling of the interior of the tubes (small fish, mussels, barnacles, sodium scale, etc.). Most of the trouble with internal tube fouling and choking will be found in the lower half and the end nearest the delivery of the circulating pump. When the ship is lying in shallow draft, river harbors, etc., particular attention must be given to keeping the intake clear. (There is nearly always a steam blowout or cleanout valve at the bottom or neck of the injection valve.) When the strainer over the intake is choked, the circulating pump is slowed down or stopped and the injection valve closed, then the full boiler pressure is slowly admitted below the valve disk, which blows out and sets up a violent agitation of the water in and around the strainer compartment.

The interior fouling and scale can be removed by several methods. The cleaning, if to be complete, calls for the removal of the large heads; this permits accessibility to all tube ends. Small round wire fagot tube cleaning

Fig. 1

brushes, as shown in Fig. 1, are used when the fouling is soft and easily removed; they are pushed through by small round rods.

After the brush has been passed through the tubes, they are washed out by water pressure admitted in a specially designed nozzle (Fig. 2) which takes in two or more tubes. It is made from an ordinary pipe cap, in the base of which are drilled and tapped two ¾-inch pipe holes for two short pieces of ⅜-inch pipe; these are turned down taper to fit the ends of the condenser tubes quickly and easily.

There are several types of mechanical tube cleaners for removing the scale which forms on the inside of the condenser tubes. When this scale is of but minor thickness, and does not seriously cripple the condenser efficiency, it is best left alone, for it has been proven that it has a protective effect against tube corrosion. Most

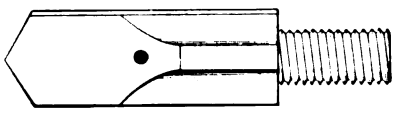

Fig. 2

mechanical power cleaners injure the small tubes. The inside diameter of most marine condenser tubes is ⅝ inch, and many of these will be found somewhat deflected and warped out of alinement. In using mechanically operated cleaners in the small tubes, many are cut and injured.

One type of scale drill is shown in Fig. 3; this is revolved by air or electric motor. Water pressure is used

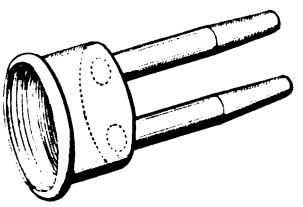

Fig. 3

in connection with its operation, the rod or shaft and the drill being hollow for the purpose. Other methods of internal tube cleaning are that of sand blasting, scraping and shooting. The shooting method consists of making several small plungers of just an easy fit in the tube, and of ½-inch length. These are placed in one end of the tube and shot or forced through by air or water pressure applied to the end of the tube.

In performing any of the above cleaning methods, it must be borne in mind that the cleaning tools are inserted and worked against the direction of the flow of the circulating water.

Perhaps I should mention here that it will be found that the lower half or bank of tubes will need cleaning more often than the upper section for two reasons: First, they will necessarily receive the foreign matter direct from the pump delivery; second, they are near to the suction of the air pumps, and should be in best condition to cool the air and condensate.

External fouling of the tubes is caused by the adherence of oil and grease carried in suspension in the exhaust steam. This, however, is easily removed by the boiling out process, and it is seldom necessary to clean the steam side more than once a year. The grease that adheres to the tubes forms a spongy coating, and into this will be found imbedded grit and fine abrasive dust from the machinery, cylinder walls, etc. The baffle plates and upper tubes will be found to receive the most of the fouling.

To remove the grease, the best method known to the writer is: Fill the shell with fresh water heated to 180 degrees. Dissolve 50 to 75 pounds of boiler compound, or a caustic soda, and pour this in through the top manhole. Then by closing the hot well, or air pump discharge valve, and making a temporary hose connection next to the

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pump, the water of the shell can be circulated by discharging from the lead of hose into the manhole on top of the condenser.

A small steam hose can be connected to keep the solution at 180 degrees temperature. In pumping back the solution, a careful man can clean all the upper tubes quickly and easily by directing the force of the hose discharge over all the surface within reach.

Generally three to four hours of circulating mixture will be sufficient to thoroughly clean badly fouled tube surfaces. The temperature should never be allowed to get much higher than 180 degrees, for it will, with the strong caustic solution, have a bad effect on the tube end packings. After completing the boiling out, the solution is drained off, and the shell and tubes thoroughly washed off with fresh, clean water.

In marine practice, a leak of the circulating sea water into the steam space is a serious thing, and steps must be immediately taken to find the leaky tube or packing and remedy it. A small size leak will salt up the feed water in a short time. In addition to the pressure of water delivered from the circulating pump, there is the pull of the vacuum to multiply the volume of any small leak into the steam space. Once in the writer's experience, an attempt was made to clean the inside of the tubes by turning live steam into the shell when the tubes were dry and the heads removed. The plan was to dry the fouling or deposit inside the tubes by baking with the steam, then blow out the dried dirt and sediment by compressed air and follow this up by washing. The plan worked well for cleaning, but resulted in many leaks around the tube ends. The packing dried out, and many of the ferrules were loosened, resulting in severe leakage of the tube sheet.

To find a leak in the steam space, there are several popular methods, but perhaps the one most applicable to all ships is that of putting a vacuum on the shell and going over the tube ends with a large torch, watching for the flame to be sucked into the leaky tube.

When possible, a better method is to fill the condenser shell slowly with water and, while the water is rising, note the ends of the tube for leaks. When the water reaches the top, apply an air pressure of 20 pounds on the surface, pumping the air in through the exhaust line, which must be blanked off. If it is a main engine condenser, and all engine parts are closed (cylinder heads, valve chests, drain valves, etc.) and the rod packings are tight, the air can be pumped into the engine exhaust direct from the compressors without the lines being blanked near the condenser, then the air pressure is built up by filling this extra volume. Leaky tubes can then be found by water spurting from their ends, and these marked for renewal. In the older types the tube ends are packed

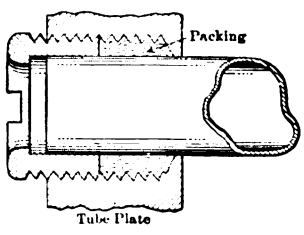

Fig. 4

in the sheet with corset lacing, this being compressed by ferrules, as shown in Fig. 4.

Modern practice calls for the tubes being expanded into one tube sheet, and packed in the other one with gray fiber washers. This still permits the necessary expansion and contraction movement, and reduces the field of leakage to practically one end.

Concord, N. H. C. H. WILLEY.

Renewing a Yoke Stud

Due to the improper position in which our boiler bottom blow-off valves were installed, one of the studs of the yoke corroded severely, due to the leakage from the stuffing box striking on it. When overhauling the valve and trying to take this stud out, it became broken.

Fig. 1, at *A*, shows the original type of stud. To make one like it required a lathe, and not having any

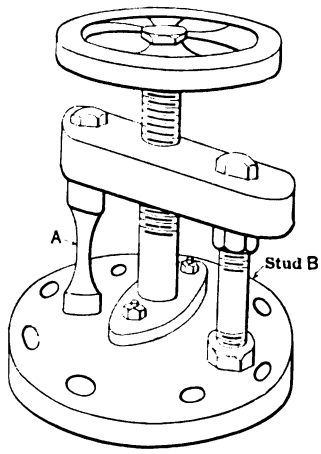

Fig. 1.—Sketch of Yoke

on board, a common ⅞-inch stud was made, as in Fig. 2, and this put in, as shown in Fig. 1 at *B*.

The distance between yoke and bonnet can be adjusted by the two nuts to correspond exactly to the same distance

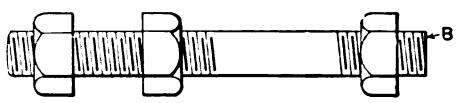

Fig. 2.—Seven-Eighth-Inch Stud

as the shoulder of the solid stud at *A*. This prevents the cocking or tipping of the yoke, which would make the stem bind. MACHINIST'S MATE.

MEN FOR THE EMERGENCY FLEET.—One of the graduates of the Shipping Board's free navigation school at San Diego recently passed his examination for second mate before the inspectors at San Pedro with the highest marks ever given in a similar examination at that port. One student in the second class about to be started at San Pedro is a university man, and is leaving an irrigation project job worth $10,000 a year to fit himself as an officer in the merchant service. He has had sea experience.

AMERICAN FOREIGN TRADE IN SEPTEMBER.—American exports in September totaled $456,201,567 (£93,500,000), according to a statement just issued by the Bureau of Foreign and Domestic Commerce, of the Department of Commerce. This is a decrease of approximately $34,000,000 (£7,000,000) compared with August, but a gain of $80,000,000 (£16,400,000) as compared with July. For the nine months ended with September the total exports were $4,607,817,178 (£945,000,000), a gain of $657,000,000 (£135,000,000) over the similar period in 1916.

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Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding will be Answered in this Department

CONDUCTED BY H. A. EVERETT*

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

There will appear in this column from time to time questions which have been asked by the Board of Steamboat Inspectors in the various examinations for engineers' licenses conducted by them. Such questions will be denoted by an asterisk (*) placed before the number if from examination for grade of chief, and by a dagger (†) if from examination for other grades.

Scotch Boiler

Q.† (921).—Sketch a sectional view of a Scotch boiler (single ended), naming each part, and state fully how each part is secured in place.

A. (921).—A sectional view of a single-ended Scotch boiler is shown in Fig. 1.

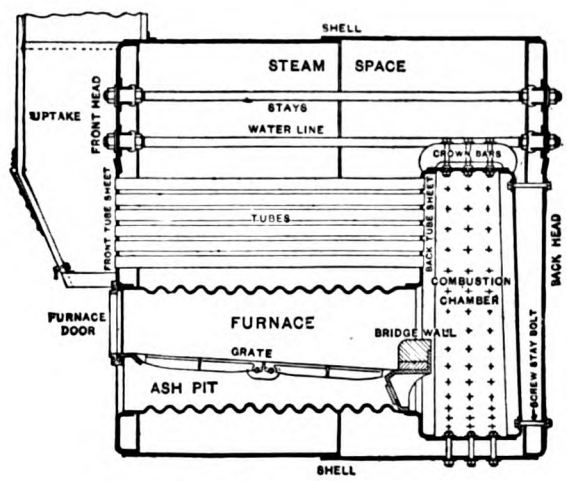

Fig. 1.—Scotch Boiler

Name of Part	Secured to	How Secured
Furnace	Front head	Riveted to flange
	Front of combustion chamber	Riveted to flange
Combuston chamber	Furnace	Flanged and riveted
	Back head	Staybolts
	Bottom	Staybolts
	Tubes	Tubes expanded into it
Tubes	Combustion chamber	Expanded into
	Front head (tube sheet)	Expanded into
Uptake	Front head	Bolted to lugs
	Top	Bolted to lugs
Stays	Front head	Bolted
	Back head	Bolted
Heads	Shell	Flanged and riveted

Evaporator

Q.* (922).—What is an evaporator with one or two sections and how would you take care of evaporator?

A. (922).—An evaporator is a device to produce fresh water from sea water by boiling it and condensing the vapor. If it is used for make-up feed, only the steam from the sea water in the evaporator is led directly to the main condenser, where it is condensed and enters the regular feed system via the hot well. If the evaporator

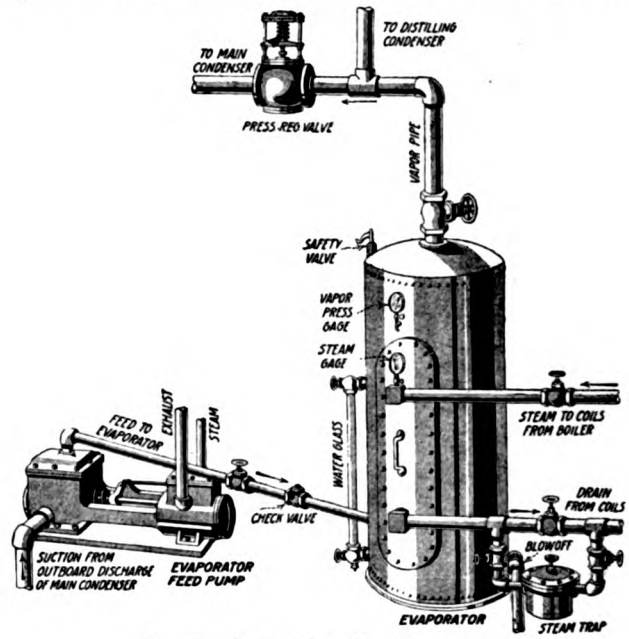

Fig. 2.—Boiler Make-Up Evaporator

is used for the production of drinking or potable water, the steam from the sea water is led to an independent condenser and the condensate thence to special tanks.

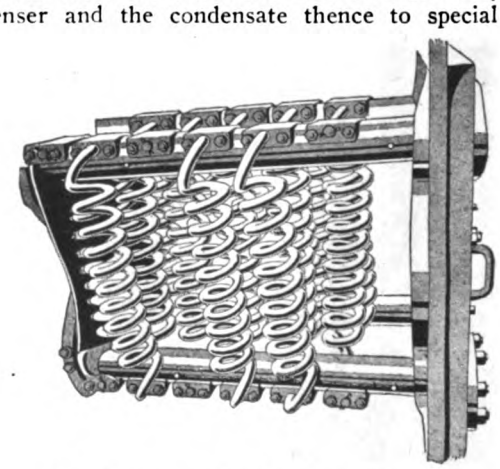

Fig. 3.—Evaporator Coils and Manifold

When used for this latter purpose, it is usually called a "distiller."

A common type of evaporator consists of a shell containing the salt water into which are immersed a number of brass (not copper) coils, through which hot, live steam flows, giving up sufficient heat to boil the water in the shell. A characteristic arrangement of an evaporator is shown in Figs. 2 and 3, illustrations reproduced from *Power*.

In starting an evaporator for the first time, it is desir-

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able to apply the full steam pressure that the coils are intended to carry to search out any leaks that may be there. If tight, start the salt water feed pump and fill the shell to about 2 inches in the gage glass. When the salt water boils the level will rise considerably. Adjust the steam valve to the coils to give the desired pressure in the coils and the vapor valve to give the desired shell pressure. These pressures vary in different installations, but should always be enough different so that the difference in the temperature of steam corresponding to each pressure will be not less than 25 degrees F. This is for low capacity operation. The rated capacity is usually based on a temperature difference of 90 degrees, for which the following table gives the

Desirable Steam Pressure for Different Vapor Pressures

Coil Pressure (Gage)	Vapor Pressure (Gage) Atmos.
55	1
58	2
61	3
65	4
68	5
72	6
75	7
78	8
80	9
85	10
87	

Watch the stopcocks on the manifold drain, which should be open to bleed air and vapor continuously.

The level of the water in the gage glass is (when operating nearly full capacity) nearly 12 inches below the actual water level, due to the priming of the salt water, and care should be taken to see that the coils are kept fully submerged. This will be done if the water is kept halfway up the glass.

Blow down frequently to maintain salinity of not over 3/32 and preferably less.

Evaporators should be scaled after 250 to 300 hours' use, as the scale on the coils reduces their heat transferring ability to a marked extent.

Cast iron shells are better for evaporation than steel plate shells.

Salinometer

Q.* (923).—In case you broke a salinometer, how would you make one to serve the purpose?

A. (923).—First obtain a slender bottle, and place a small amount of buckshot in it, and cover the latter with wax or paraffine. Place the prepared bottle in a container of fresh water, and then mark the water level upon the bottle. This will be the zero of the scale to be made. Take a gallon of sea water and proceed as above to determine the 1/32 reading. Then take two gallons of sea water and boil it until one gallon remains. Then, as before, determine the flotation point. In like manner boil three gallons of sea water until one remains, and determine the 3/32 point. (The above procedure only applies when the sea water used is of 1/32 salinity: the waters of the Atlantic and Pacific oceans are very nearly 1/32 saline.) Thus the bottle has graduations for 0, 1/32, 2/32 and 3/32 salinity, and may be used successfully as a salinometer.

Precautions for Marine Engineers

Q. (924).—What precautions and preventions should a marine engineer take? Name nine different places.

A. (924).—"Practical Marine Engineering," by C. W. Dyson, suggests the following as desirable routine orders for the engine room in port: "Be careful to secure pumps, air compressors, etc., when they are no longer needed. Clean engine room bilges each week on day assigned. Allow no one in engine rooms or fire rooms from 9 P. M. to 5 A. M. except men on watch and those on duty. No smoking in engine room hatches. Men will be kept out out of hatches except those detailed there for cleaning stations. Keep all unnecessary lights turned out at night. In general, run evaporators on ship's tanks from 8 A. M. until they are full, then shift below to reserve feed tanks for the night. This will avoid overflowing ship's tanks during the night. Jack, daily, auxiliaries not in use. The oiler on watch should always know who are the officer and chief petty officers on duty. Their names should be entered on the auxiliary watch list or condition blank kept at engine room log desk. In case of any accident or derangement the officer and chief petty officers on duty will be informed."

Separators

Q. (925).—What are separators and where are they used?

A. (925).—Separators are devices, found in great variety, for separating steam and water, and utilize various principles in their operation. Separators are used on steam lines, or, wherever the steam is likely to have any considerable proportion of water.

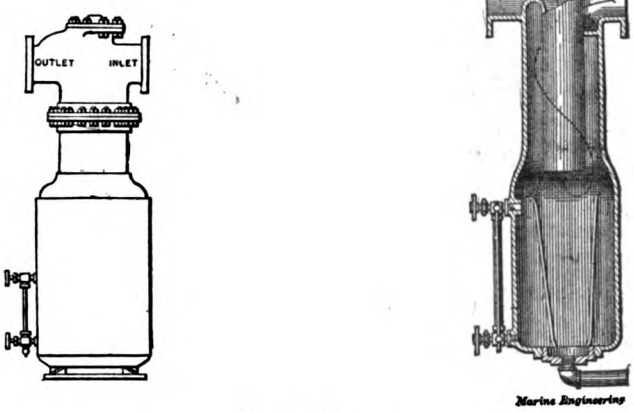

Fig. 4.—Separator

Horsepower Constant

Q. (926).—What is the constant for horsepower and how is it obtained?

A. (926).—Engine constant is a factor determined for each cylinder of the engine from the dimensions of the cylinder. It is the part of the formula for indicated horsepower enclosed in the brackets:

$$I.H.P. = \frac{2PLAN}{33{,}000} = PN\left[\frac{2LA}{33{,}000}\right]$$

P = average mean effective pressure, pounds per square inch,
N = revolutions per minute,
L = stroke in feet,
A = average area of the two sides of the piston, square inches.

$$\text{Engine constant} = \frac{2LA}{33{,}000}$$

Degree at Which Salt Deposits

Q. (928).—At what degree does salt deposit?

A. (928).—Salt deposits at 8/32 to 10/32 (25 to 30 percent).

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MAIN BATTERIES OF THE U. S. S. PENNSYLVANIA

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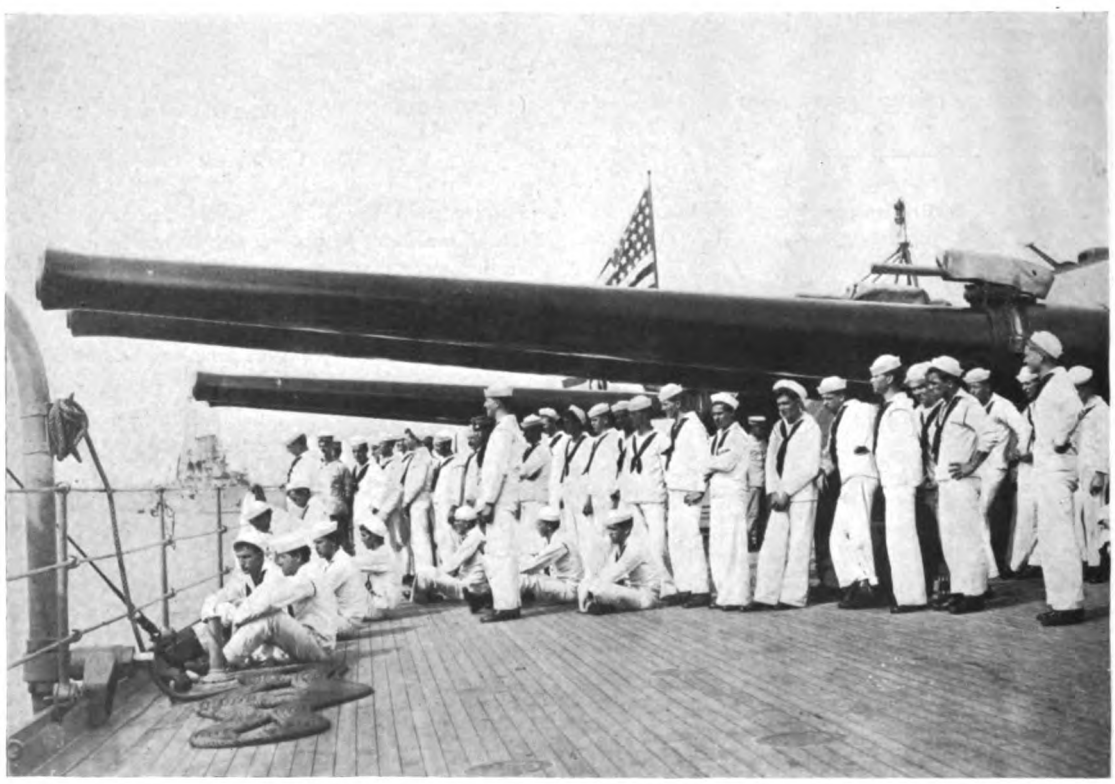
Forward Turrets



After Turrets

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Shipbuilding and General Marine News

Contracts for New Ships—Shipyard Improvements—Engineering Projects—Improved Appliances—Personal Items

LARGEST CONTRACT SO FAR LET BY THE EMERGENCY FLEET CORPORATION

Seventy 8,000-Ton Fabricated Steel Ships to Be Built in One Year by the American International Corporation

Contract Involves Expenditure of Nearly $100,000,000

The American International Corporation, with headquarters at the Bellevue-Stratford Hotel, Philadelphia, which is to operate the Government fabricating shipyard at Hog Island, Philadelphia, has received the largest ship contract so far let by the Emergency Fleet Corporation. This contract calls for the building of seventy 8,000-ton fabricated steel vessels designed to have a speed of 15 knots.

The American International Corporation previously had a contract for fifty 7,500-ton vessels totaling about $50,000,000. The new contract makes it necessary for the corporation to turn out, if possible, within a year 130 vessels of over 1,000,000 tons deadweight carrying capacity, or more than the entire shipbuilding output of the United States in 1916.

Irving T. Bush Becomes Executive Head of New York Port War Board

Irving T. Bush, founder and head of the Bush Terminal Company, has been appointed executive head of the New York Port War Board by Secretary of War Baker. Under his direction all docks, boards, terminals and storage houses on the New York and New Jersey water fronts of New York harbor will be centralized and brought under federal control.

It is believed that with the present development the facilities of the port can be extended at least 25 percent by the elimination of useless competition. Since 80 to 90 percent of American exports must pass through New York harbor every effort will be made to remove obstacles in the way of an interrupted flow of supplies to Europe.

J. R. Flannery Given Charge of Housing Problem at Shipyards

J. R. Flannery, president of the Vanadium Steel Company, Pittsburgh, has been drafted into the service of the Shipping Board temporarily to assist in solving the housing problem at various shipbuilding yards. The most pressing needs just now are at the plants near Baltimore and Newport News, where accommodations are lacking for the hundreds of new workmen being pressed into service.

J. Barton Payne, of Chicago, who has been serving as counsel for the Shipbuilding Wage Adjustment Board, has become chief counsel of the Shipping Board Emergency Fleet Corporation.

REAR ADMIRAL CAPPS SUCCEEDED BY REAR ADMIRAL HARRIS

Ill Health the Reason for Admiral Capps' Resignation

Rear Admiral W. I. Capps, who has acted as general manager of the United States Shipping Board Emergency Fleet Corporation, since the resignation of Major General George W. Goethals, has been forced to relinquish his duties on account of ill health.

Admiral Capps' resignation was accepted with regret by the President, and the vacancy has been filled by the appointment of Rear Admiral F. R. Harris, chief of the Bureau of Docks and Yards of the Navy.

Great Lakes Engineering Works Building New Yard on Pacific Coast

The Great Lakes Engineering Works, Detroit, are erecting a new shipyard at Seattle for the purpose of building for the Emergency Fleet Corporation boats of about 9,400 tons deadweight capacity. The company's board has been reorganized, and President A. C. Pessano has become chairman, with offices in New York City. Other officers are: President, John R. Russell; vice-president and treasurer, H. W. Hoyt; vice-president and general manager, John A. Ubsdell; secretary, F. G. Morley.

The present contracts alone will average one ship every two weeks for delivery during the year 1918. The company has made important extensions to its three plants recently, spending in these improvements nearly $500,000.

Contracts for Twenty Steel Vessels of New Type Let by Shipping Board

The Shipping Board has placed contracts for the construction of twenty so-called unsinkable ships with the Foundation Corporation of New York. The vessels are of steel of about 4,000 tons, and will be constructed in a Southern yard.

The design of these vessels has been developed by a French naval constructor, and, roughly, consists of two horizontal cylindrical tanks placed side by side, decked over at top and bottom and fitted with ship-shape ends. The tanks are thoroughly sub-divided, and, it is claimed, offer maximum resistance to destruction by torpedo or mine attack.

SHIPBUILDERS ASK FOR REPRESENTATION ON COUNCIL OF NATIONAL DEFENSE

Petition Sent to President Wilson by Society of Naval Architects and Marine Engineers.

Appointment of Representative Builder of Merchant Ships Suggested

American shipbuilders are unanimously agreed that the shipbuilding industry of the United States should have a representative on the Council of National Defense, where other important industries are now represented by recognized experts.

At the recent annual meeting of the Society of Naval Architects and Marine Engineers, the following petition was sent to the President of the United States, making an earnest appeal for the appointment of a representative builder of merchant ships as a member of the Council.

Whereas, Our country is assuming an increasing large proportion of the burden of carrying on the World War against autocracy; and

Whereas, the production of merchant ships to combat the losses sustained from submarine attacks, mines and other perils of the sea has become of paramount importance; and

Whereas, the assistance and co-operation of the most experienced shipbuilding talent in this country are required for the designing, building and equipping of ships, as well as for the direction of our shipyards, in order that the necessary ships may be quickly completed to meet the urgent needs of the hour; and

Whereas, at the present time, no experienced builder of merchant ships occupies any position where the counsel of such men is heard in the decision of national policies, while other important industries are now represented by recognized experts; be it therefore

Resolved, that the Society of Naval Architects and Marine Engineers, at its twenty-fifth assemblage in the city of New York, on November sixteenth, most respectfully and urgently petitions the President of the United States of America to appoint as a member of the Council of National Defense a representative builder of merchant ships who shall by reason of his experience, ability and business vision be qualified to sit in the high councils of that most important body.

(Signed) STEVENSON TAYLOR,
Lieutenant Commander U. S. N. R. F.,
President Society of Naval Architects and Marine Engineers.

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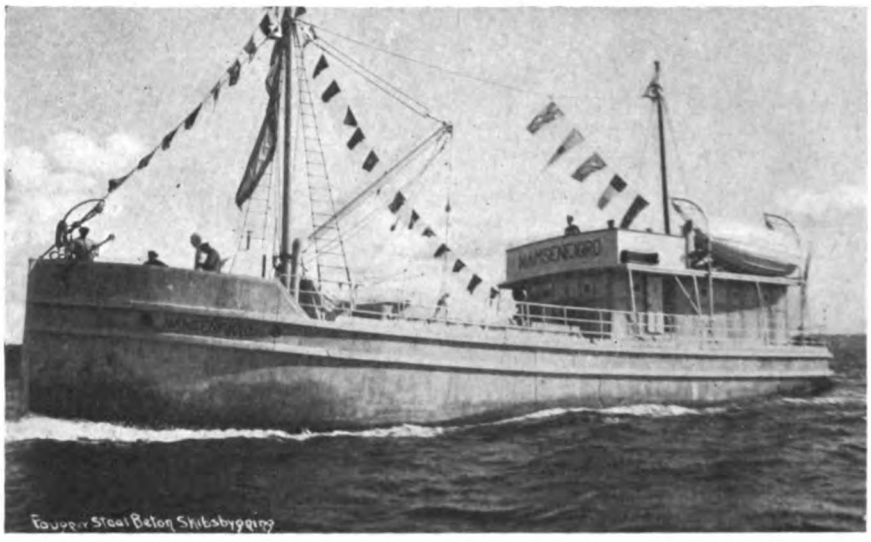

Concrete Motorship *Namsenfjords*

Ferro-Concrete Motorship Namsenfjords

Through the courtesy of Mr. Nic. K. Fougner, president of the Fougner Steelconcrete Shipbuilding Company, Christiania, Norway, we are able to show on this page a view of the ferro-concrete motor ship *Namsenfjords*, which is the first sea-going vessel of this type which this company has built.

The vessel is 84 feet long, 20 feet beam, and on a draft of 11 feet 6 inches carries 200 tons of cargo. Propulsion is by an 80-brake horsepower Bolinder's engine giving a speed of 7½ knots. On trial the vessel behaved excellently in a seaway with practically no vibration discernible.

Shipyard Wages Fixed by Board

Uniform minimum wage scales for the Pacific Coast shipbuilding yards, a guide for all shipyards in the country, were announced in San Francisco on November 4 by the United States Shipbuilding and Labor Adjustment Board.

The decision effects an increase of from 10 to 30 percent over the old scale here, although its uniformity makes it lower in some localities than the temporary scale now in force.

"The Board found living costs had increased 36 percent. The men want enough to meet this."

The scale rates are retroactive, going back to the Puget Sound district to August 1. They must be put into effect on or before Monday, November 12, the Board ordered, and back pay must be paid within two weeks from that time. Rates of wages now being paid in excess of the minimum rates fixed are to be in no wise altered.

An eight-hour day was fixed for the San Francisco and Portland district.

The minimum scale, uniform for the Pacific Coast, was fixed as follows:

Journeymen machinists, molders, blacksmiths, anglesmiths, pipe fitters, boiler makers, ship fitters, pressmen, angle and frame setters, riveters, chippers and calkers, acetylene workers and electrical workers, $5.25 per day.

Painters and plate hangers, $5.

Sheet metal workers, coppersmiths and flange turners, $6.

Heaters, foundry carpenters, furnace men and punch and shear men, $4.50.

Patternmakers, $6.50.

Planer men, counter-sinkers, drillers and reamers and holders, $4.20.

Machinist specialist, $4.

Rivet heaters, $3.15, and laborers, $3.25.

Helpers are divided into two classes, as follows:

Machinists, pipe fitters, sheet metal workers, ship fitters, electrical workers, molders, helpers, $3.60.

Blacksmiths, coppersmiths, slab, plate hangers, hook tenders, flange fire and machine helpers and casting cleaners. $3.90.

In yards where wooden ships are being constructed the minimum rate for calkers is fixed at $6.50, shipwrights, joiners, boatbuilders and mill men, $6, and laborers and helpers, $3.25.

Examination to Establish a List of Eligibles for Enrollment as officers in the Civil Engineer Corps of the United States Naval Reserve Force

An examination, which will close at noon of December 31, 1917, will be held at the Bureau of Yards and Docks, Navy Department, Washington, D. C., to establish a list of eligibles for enrollment in the Civil Engineer Corps of the United States Naval Reserve Force.

To compete in this examination it is only necessary for the candidate to address a letter to the Reserve Examining Board, giving full information as to his education and experience with testimonials and references. A descriptive circular giving detailed information for the requirements for this examination will be sent to interested parties upon request to the Chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C.

Candidates recommended for enrollment will be authorized to appear before the nearest medical officer of the United States Navy for physical examination. Candidates found to be physically unfit will not be enrolled. A candidate must be an American citizen and must be an engineer in active practice of the profession of civil, electrical or mechanical engineering, or some business directly connected with these professions.

The age and experience requirements are for Ensign, not less than 24 years of age, with not less than two years of active professional practice; for Lieutenant (junior grade), not less than 27 years of age, with not less than five years of active professional practice; for Lieutenant, not less than 30 years of age, with not less than seven years of active professional practice, during at least three years of which candidate must have had responsible charge of work as principal or assistant.

Enrollments are for a period of four years, or during the existence of a war or national emergency. Except during a war or national emergency officers are only given active duty at their own request and then for short periods.

Pay and allowances of officers amount to approximately as follows:

Ensign, $2,100 per annum.

Lieutenant (junior grade), $2,500 per annum.

Lieutenant, $3,100 per annum.

There is an additional allowance of $150 per annum for uniforms.

Special Examinations for Cadetship U. S. Coast Guard

A special examination of candidates for cadetship (line and engineer) in the Coast Guard will be held at several of the large cities in the United States, depending upon the location of the candidates, commencing on Monday, December 17, 1917, and continuing throughout that week.

Regular examinations for these positions were held in June, but there were not a sufficient number of qualified candidates to fill the existing vacancies. It is hoped to secure a total of at least twenty cadets and cadet engineers at this special examination.

Candidates for cadets (line) must be not under 18 nor more than 24 years of age, and those for cadet engineer not under 20 nor more than 25 at the date of appointment, which will be on or about Januery 15, 1918. Line cadets undergo three years of instruction at the Coast Guard Academy, New London, Conn., upon the successful completion of which they are commissioned third lieutenants in the Coast Guard, which grade is assimilated to that of ensign in the navy and second lieutenant in the army. The pay of a line cadet is $500 a year, plus commuted rations at the rate of 45 cents a day. Cadet engineers undergo instruction for one year at the academy and receive $75 a month and commuted rations. Upon successfully completing their course they are commissioned third lieutenants of engineers. Third lieutenants, both line and engineer, receive pay at the rate of $1,700 a year, and officers commissioned in these grades are in the line of promotion to higher rank and pay.

By the terms of the Act of June 28, 1915, the former Revenue Cutter Service and Lifesaving Service were combined into the newly-created Coast Guard, which performs all of the functions formerly pertaining to the component services. In time of war or emergency the Coast Guard operates under the Navy Department as a part of the navy, but at other times it operates under the direction of the Secretary of the Treasury.

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Pamphlets giving full information and samples of previous examinations, as well as blank forms for application, may be had by addressing the Captain Commandant, United States Coast Guard, Washington, D. C.

NEW SHIPBUILDING COMPANIES ORGANIZED

Additions and Improvements to Shipbuilding Plants

The St. Louis, Mo., Chamber of Commerce has taken steps for the organization and establishment of a $1,000,000 shipbuilding corporation, to be devoted chiefly to the construction of barges, tugboats, etc., but which will also be equipped to build warships of light draft.

The Three Rivers Shipyard Company, Ltd., has been organized at Toronto, Canada, by Thomas Mulvey Kirkwood. The bonds of the company are guaranteed by the City of Three Rivers, Canada. It is stated that the yard will build wooden ships, at a cost of about $450,000 each.

The Mobile Shipbuilding Company has been organized at Mobile, Ala., by W. L. Kelly and MacR. Fife, of the Kelly-Atkinson Company, general offices, 189 West Madison street, Chicago, Ill. The new company will build single-screw composite cargo carrying steamers for the Emergency Fleet Coropration.

Thomas H. Wright, C. C. Chadbourn and Charles E. Taylor, Wilmington, N. C., are planning to build a shipyard on the Cape Fear River.

Ernest Strauss will enlarge his shipyard at Harrisburg, Tex.

Morey & Thomas, Jacksonville, Fla., have given a contract to the T. C. Dawkins Company, Jacksonville, for the erection of machine shops, offices, etc., for their new shipyard.

Heldenfels Bros., Beeville, Tex., will build a shipyard at Rockport, Tex. They are reported to have received a contract to build several wooden vessels for the Emergency Fleet Corporation.

The Ampco Shipbuilding Company, Security building, Milwaukee, is planning to build a shipyard and drydock in Milwaukee.

The Motor Ship Construction Company, Vancouver, Wash., which has contracts for more than 300 lifeboats and rafts, is enlarging its plant.

The plant of the Risdon Iron Works. San Francisco, Cal., has been commandeered by the Government and will be greatly enlarged.

Horace Turner, president of the Turner Terminal Company, Mobile, Ala., is planning to build a shipyard.

The Pelican Motor Ship Company has been incorporated to build a shipyard. M., P. H. and C. Zornow, 1270 Broadway, New York, are the incorporators.

The Manistee Shipbuilding Company, Manistee, Mich., has made a large investment in machinery to repair old boats.

The Biddeford Shipbuilding Company has been incorporated by E. L. Morrill, Saco, Me., George C. Fogg, Biddeford, Me., and others.

The Hoosac Lumber Company has been incorporated to build ships. Huntington P. Faxson, Cambridge, Mass., is president.

The Barge & Lighter Repair Company has been incorporated to operate a boat works. John H. Patterson, William N. Sewell and Chas. J. Gormley, of Jersey City, N. J., are the incorporators.

The Gas Engine & Power Company and Chas. L. Seabury & Company, Con., Morris Heights, New York, have prepared plans for the construction of three shipways at 177th street and Harlem River.

The Clinton Shipbuilding & Repair Company has been incorporated. F. J. Bradley, Philadelphia, Pa., is treasurer.

Grant-Smith-Guthrie-McDougall, Portland, Ore., is planning the construction of another shipyard.

The Puget Sound Machinery Depot, Seattle, Wash., has purchased land, in which it will, so it is reported, erect a plant to cost $1,000,000, where it will manufacture patterns for ship machinery, boilers, shafting, etc.

The Tide Water Shipwrights, Inc., has been organized by M. P. Wheeler, W. Brown and L. W. Davidson, 18 Christopher street, New York.

The Donohoe-Rathbone Shipbuilding Company has been organized in Seattle, Wash., to build wooden vessels.

The Ames Shipbuilding & Dry Dock Company, Seattle, Wash., has bought water-front property on which it will erect another shipbuilding plant.

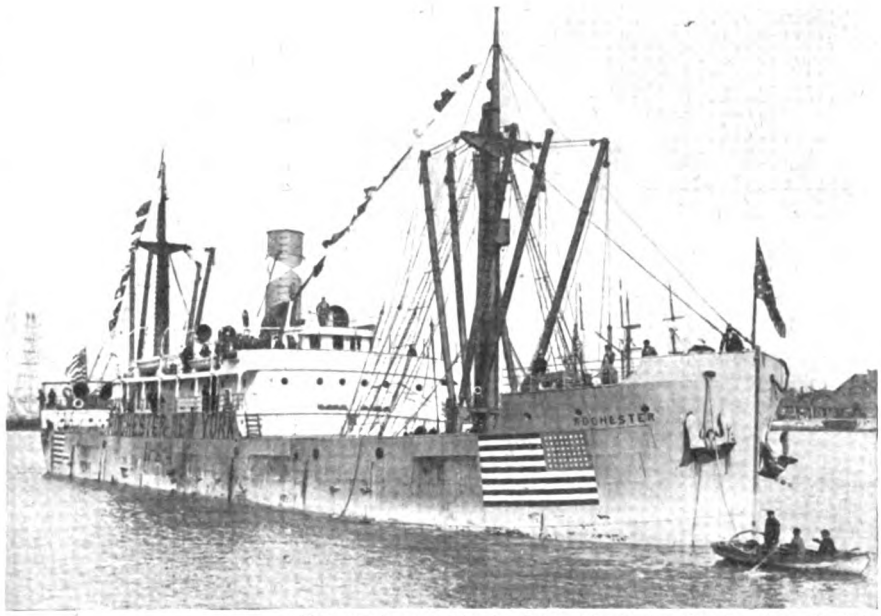
It is reported that the Southern Pacific Company, San Francisco, Cal., contemplates the erection of a shipbuilding plant near Alameda.

The Erickson Engineering Company, Seattle, Wash., has been incorporated, and is building shipways on the Duwamish River.

The William Cramp Ship & Engine Building Company, Philadelphia, has purchased the De La Vergne Machine Company's plant, covering about 5½ acres in New York City, for building engines.

A shipbuilding plant has been established on the Ala Moana beach, half a mile distant from the Honolulu Iron Works, Honolulu, where three schooners are now being built.

Enlargement of the Skinner & Eddy shipbuilding plant is proceeding at Seattle. Two big outfitting wharves, each 850 feet long and 65 feet wide, are being built in the added area of the site. Between them a 125-foot slip is being dredged to a depth of 30 feet. On the north side of the No. 2 wharf there is to be another 125-foot slip. In reality the two slips will be huge outfitting basins. The site now contains 27 acres. The additions to the plant will cost approximately $1,000,000, and when they are completed the yards will represent an investment of more than $4,000,000. The plant's launchings this year will total 11, and 16 launchings are now lined up for 1918.



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S. S. *Rochester*, Recently Sunk by German U-Boat

Shipbuilders Awarded Contracts for New Vessels

The American International Shipbuilding Corporation, which is to operate the Government yard at Hog Island on the Delaware River, has been authorized by the Emergency Fleet Corporation, Washington, D. C., to build seventy 8,000-ton steel steamers within twelve months from the completion of the yard. The temporary office is in the Bellevue-Stratford Hotel, Philadelphia, Pa.

The Jancke Navigation Company, New Orleans, La., has received a contract from the Emergency Fleet Corporation, Washington, D. C., to build twelve 5,000-ton steel ships. It is stated that all these ships will use fuel oil.

The Southern Shipbuilding Company has secured a site on the Cooper River, near Charleston, S. C., and will build steel steamships. It is understood that the company has received a contract from the Emergency Fleet Corporation to build a large number of these vessels. H. N. Whittelsey, 17 Battery Place, New York, is president of the company.

The Tampa Shipbuilding & Engineering Company, Tampa, Fla., is building

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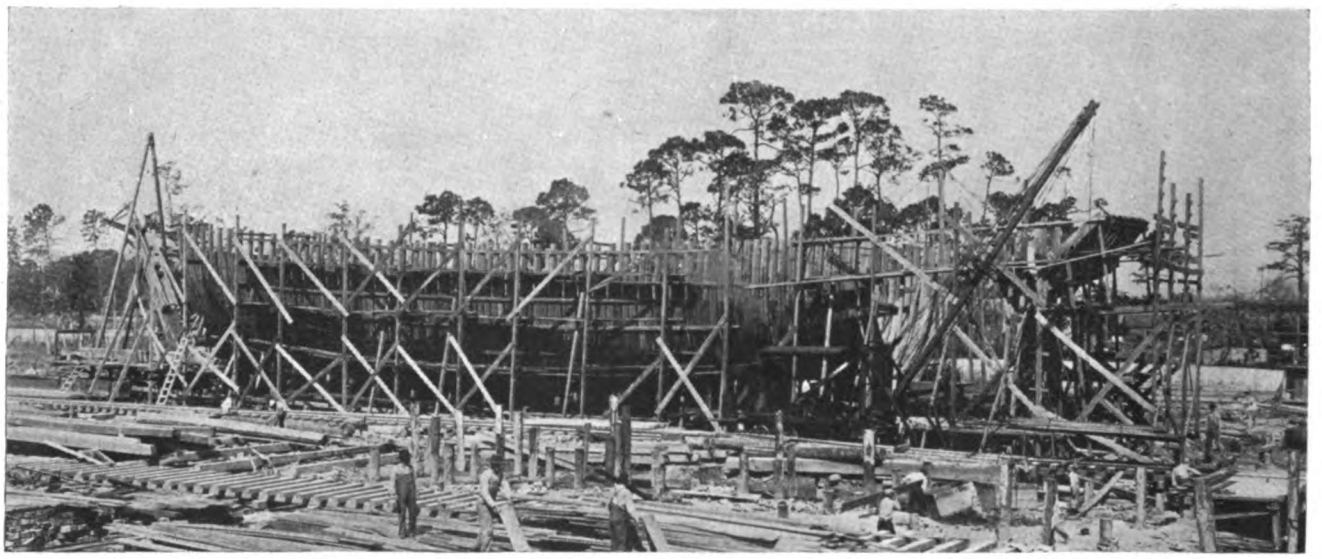

Fig. 1.—Shipyard of Bagdad Shipbuilding Company, Showing Auto Crane in Operation

two 3,500-ton steel steamships from plans by J. W. Millard & Bro., 17 State street, New York.

The Eastern Shore Shipbuilding Corporation, Sharptown, Md., is building a wooden schooner for Theodore B. Johnson, 17 Battery Place, New York.

The Hampton Roads Dry Dock Corporation, Hampton Roads, Va., is reported to have received a contract from the Emergency Fleet Corporation to build four steel steamships.

It is reported that the American Shipbuilding Company, Portland, Ore.; the Pacific Shipbuilding Company, Seattle, Wash., and Meacham & Babcock, Seattle, Wash., have been authorized by the Emergency Fleet Corporation to build wooden vessels for the French and British Governments.

It is reported that the Elliott Bay Shipbuilding Company, Seattle, Wash., has received contracts to build several ocean-going wooden motor boats.

The Daniels Construction Company, New York City, is reported to have received a contract from the Emergency Fleet Corporation to build twelve 9,500-ton steel steamships in a plant to be erected near Brunswick, Ga.

The Emergency Fleet Corporation has placed a contract for four cargo boats with the Newburgh Shipyards, Inc. It is understood that each of these ships will be of 5,000 tons deadweight.

A contract has been let by the United States Shipping Board to the Hampton Roads Dry Dock Corporation to build four steel ships of 7,300 tons capacity each.

Byers' Shipbuilding Auto-Cranes Installed by Bagdad Shipbuilding Company

The Bagdad Shipbuilding Company, Milton, Fla., has recently put into operation one of the shipbuilding auto-cranes manufactured by the John F. Byers Machine Company, Ravenna, Ohio. The crane is self-propelling, and is mounted on rail trucks for operation on tracks laid alongside the shipbuilding berths. The crane is fitted with a 40-foot beam, and has a capacity as a derrick of 4,500 pounds at a 20-foot radius. The crane is operated by a steam Byers' locomotive crane-type engine of 25 horsepower and has a propelling speed of 200 feet per minute. The total weight of the crane is 14 tons, and it is mounted on a two-wheel rigid truck at the front end and a four-wheel swivel truck at the rear end.

These cranes can be furnished with gasoline (petrol) or electric power, and mounted on road wheels, if desired. The shipbuilding crane can be speedily changed to accommodate a clamshell or orange-peel bucket for excavating work or for rehandling loose material. The cranes are equipped with two or three drums, as desired, or a three-drum can be added in the field.

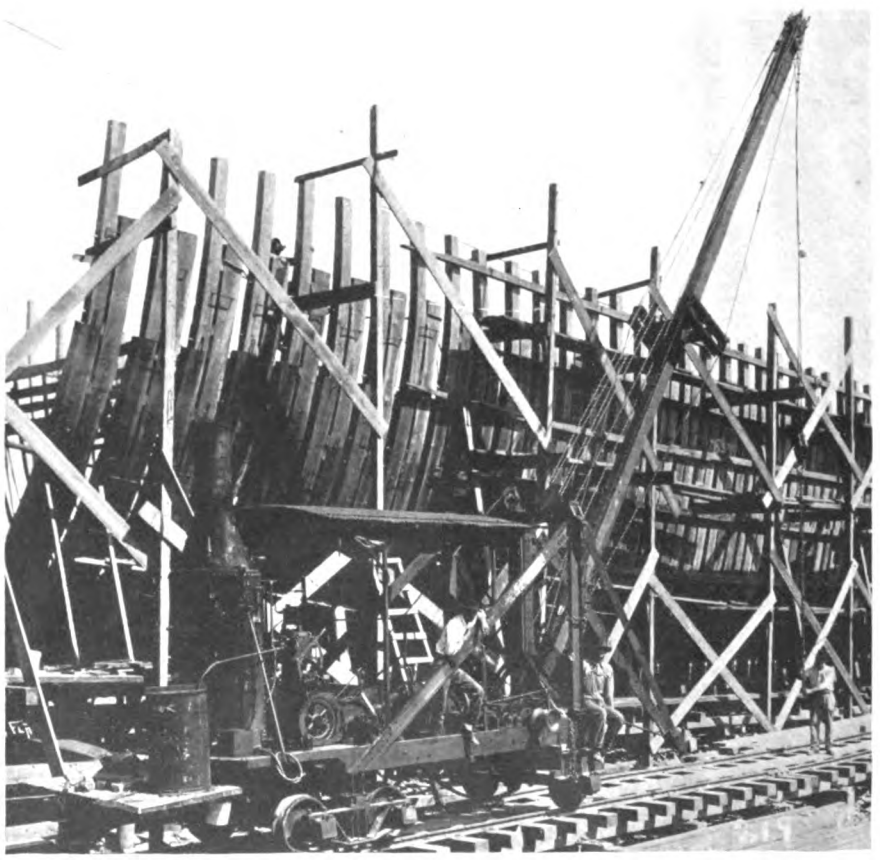

Fig. 2.—Byers' Shipbuilding Auto-Crane

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Sun Shipbuilding Company Launches Its First Vessel

The Sun Shipbuilding Company, Chester, Pa., launched on October 30 its first vessel, the 10,000-ton bulk oil steamer *Chester Sun*, built to the order of the Sun Company, of Philadelphia. The vessel is 445 feet long over all, 430 feet between perpendiculars, 59 feet molded beam, and 33 feet 3 inches molded depth, with a gross tonnage of 6,683 and an indicated horsepower of 2,500, designed to give a service speed of 10½ knots with the vessel carrying 10,300 tons on a draft of 25 feet 6 inches.

The vessel is of the three-island type, having complete main and upper decks, expansion trunk and poop, bridge and forecastle decks of steel. The main cargo space is divided into nine tanks on each side, which, together with the summer tanks, give a total cargo capacity of 3,300,000 gallons. Fuel oil tanks, with a total capacity of 380,000 gallons, are also provided.

Propulsion is by a triple-expansion engine with cylinders 27 inches, 45½ inches and 76 inches diameter by 51 inches stroke, supplied with steam at 190 pounds per square inch working pressure by three single-ended Scotch boilers, 15 feet 3 inches diameter by 11 feet 5 inches long. The usual auxiliaries are fitted, including two large cargo oil pumps located in the pump room amidships. The vessel has been requisitioned by the Emergency Fleet Corporation.

Following the launching an elaborate luncheon was served in the mold loft of the yard to a large company of guests who witnessed the ceremony, Mr. S. Howard Pew, president of the Sun Shipbuilding Company, presiding as toastmaster.

Recent Launchings

At Gloucester City, N. J., on November 10, the Pennsylvania Shipbuilding Company launched the 7,000-ton oil tank steamer *John M. Connelly*.

At Seattle, on November 6, J. F. Duthie & Company launched the 8,000-ton deadweight freighter *Hallbjorg*, built for Norwegian account.

At Ecorse, Mich., on October 30, the American Shipbuilding Company launched the 12-000-ton lake bulk freighter *August Ziesing*.

On November 1, sixty-four days from the day of laying the keel, Skinner & Eddy launched the 8,800-ton steel freighter *War Flame*, which is the eighth ship this yard has turned out this year. The *War Flame* was ordered by the Cunard Line for Chambers & Company, of Liverpool, but she has been commandeered by the Government.

Navy Department Calls for 7,000 Firemen by December 15

The Navy Department has sent telegrams to its recruiting officers in all parts of the country directing them to begin an active campaign to enlist 7,000 firemen by December 15. The quotas assigned for the various districts are: Eastern district, 2,000; central, 2,000; southern, 1,000; western, 2,000.

For firemen men from 18 to 35 years of age will be accepted. No previous experience in firing is required, but men must be physically qnalified for the work.

Courses in Naval Architecture and Marine Engineering Established at Polytechnic Institute of Brooklyn

To meet the demand for professionally-trained shipyard employees, the Polytechnic Institute of Brooklyn has established evening courses in naval architecture and marine engineering. These courses aim to give the students such a comprehensive training that when they enter a shipyard or a ship drawing office, they will understand what is wanted of them and how to proceed in accomplishing it. Additional and advance courses leading to the degree of Bachelor of Science in marine engineering and naval architecture may be offered later.

The courses are in charge of A. Mathies, a graduate of the University of Michigan, who is connected with the Federal Shipbuilding Company of New York, and holds a commission in the United States Naval Reserve Force, and Dan D. Gardner, also a graduate of the University of Michigan, who is at present boiler designer for the Federal Shipbuilding Company of New York.

"Victory" Plant Being Pushed to Completion

The new $9,000,000 destroyer plant which the Bethlehem Steel Corporation are having built at Fore River by the Aberthaw Construction Company is rapidly taking shape. In addition to the main plant, work is going forward on Victory Plant No. 2 at Buffalo, which is to be occupied by the Bethlehem Steel Corporation about January 15. In this plant the turbines are to be made for the destroyers.

The Buffalo plant will occupy 15 acres of land, near Tonawanda, and the main building will be 750 feet by 200 feet, with a boiler house and administration buildings added. The construction throughout will be of steel and concrete, over 1,500 tons of steel being used in the construction, and will require 3,000 men.

The cost of the construction of this plant, aside from that at Squantum, will be $1,500,000. Power for the operation of this plant will be furnished by a new power house recently erected at Buffalo by Stone & Webster ,of Boston.

L. C. Manuell, representing the Bureau of Yards and Docks of the Navy Department at Washington, represents the Government at this plant and has general supervision of the work.

Davis Shipyard Reorganized and Enlarged

The shipbuilding partnership of M. M. Davis & Son, at Solomons, Md., and Moses, Pope & Trainer, engineers, of New York City, have joined forces and incorporated the yard under the name of M. M. Davis & Son, Inc. The officers of the new company are: President, M. M. Davis; vice-president and manager, Clarence E. Davis; secretary and treasurer, J. N. Trainer, Jr. A New York office has been opened at 366 Fifth avenue, New York City.

Ample capital has been secured with which to enlarge the yard and take on new work in addition to the present construction on the barges and towboats for the Bethlehem Steel Company, and the Northern Transportation Company of Baltimore. The forces will be increased at once.

PERSONAL

HUGO FREAR, formerly with the Union Iron Works, San Francisco, Cal., has been appointed naval architect of the Bethlehem Shipbuilding Corporation, which will have charge of all the designing work for the various shipyards owned by the Bethlehem Steel Company.

H. E. LEWIS, formerly assistant to the president of the Bethlehem Steel Company, has been elected vice-president of the company.

E. B. HILL, formerly treasurer of the Fore River Shipbuilding Corporation, Quincy, Mass., has been elected treasurer of the Bethlehem Steel Company.

WILLIAM G. COXE, president of the Harlan & Hollingsworth Corporation, Wilmington, Del., has resigned on account of ill health.

DUDLEY R. KENNEDY, formerly assistant to the president of the Youngstown Sheet & Tube Company, has been appointed head of the Department of Industrial Relations of the American International Shipbuilding Company, Philadelphia.

WILLIAM P. ROTH has been elected vice-president and general manager of the Matson Navigation Company, San Francisco, Cal.

CAPT. E. O. PATTERSON has been appointed by the United States Shipping Board as resident inspector in charge of the steamships building by the Cumberland Shipyard, Portland, Me.

JAMES MONTGOMERIE, who has been principal surveyor of Lloyd's Register of Shipping at Glasgow since May, 1916, has been appointed Lloyd's Principal surveyor for Scotland.

E. B. EGBERT has been appointed hull and machinery inspector for the United States Shipping Board Emergency Fleet Corporation, with headquarters at Portland, Ore.

CAPT. LEWIS S. JORDAN, former assistant United States inspector of hulls, is now surveyor of hulls for the American Bureau of Shipping in the Washington-Oregon district.

L. E. GEARY, of Seattle, has been appointed naval architect for the United State Shipping Board's Seattle district.

D. W. KALLIS, former chief of the hull drafting office of the Seattle Construction & Dry Dock Company, is employed in the office of the United States Shipping Commission at Seattle. He has been succeeded by J. K. Ingham.

P. S. STONE, for a number of years chief draftsman in the office of the United States Naval Constructor at the yard of the Seattle Construction & Dry Dock Company, has accepted the position of naval architect for the Patterson-McDonald Company, of Seattle. Oscar A. Seigley is the new chief in the Naval Constructor's office.

PROF. C. D. SHANE is in charge of a school of navigation which has been opened in Bellingham, Wash.

CAPT. WILLIAM FISHER has been appointed inspector of hulls for the Seattle district, to succeed Capt. B. B. Whitney, now head of the American Bureau of Shipping in Washington and Oregon.

OBITUARY

WILLIAM D. KEARFOTT, president of the Kearfott Engineering Company, New York, died from apoplexy at his home in Montclair, N. J., on November 12, at the age of 53 years.

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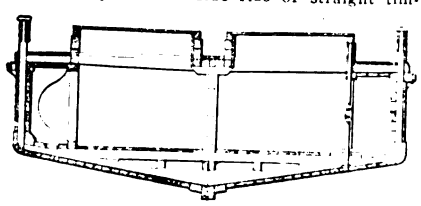
SELECTED MARINE PATENTS

The publication in this column of a patent specification does not necessarily imply editorial commendation.

American patents, compiled by Delbert H. Decker, Esq., registered patent attorney, Millerton, N. Y.

1,228,922. WOODEN BOAT. EDWARD S. HOUGH, OF OAKLAND, CAL.

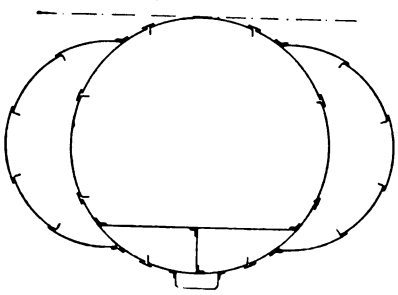
Claim 1.—A ship frame in wood comprising a plurality of transverse bottom members of straight timbers meeting each other at the medial line of the vessel at their inner ends, substantially vertical side ribs of straight tim-



bers, secured at the outer ends of said bottom timbers, transverse floor timbers secured at their outer ends to said bottom timbers, and longitudinal stringers intermediate of said bottom timbers and floor timbers. Three claims.

1,229,004. CONSTRUCTION OF SUBMARINE VESSELS. HAROLD EDGAR YARROW, OF SCOTSTOUN, GLASGOW, SCOTLAND.

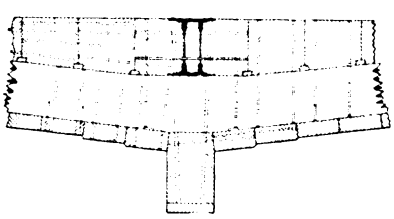
Claim 1.—In a submarine vessel, of the type in which the hull is approximately in the form of a tube of annular cross section, external plates connected by longitudinal and transverse



butt straps adapted to sustain, without the addition of transverse frames, the bending moments and external pressure to which the vessel is exposed, substantially as described. Three claims.

1,229,413. SHIP CONSTRUCTION. RICHARD CHILCOTT, OF PORTLAND, ORE.

Claim 1.—In ship construction, in combination with the floor ceiling timbers and keel, a steel girder extending lengthwise of the ship above the keel thereof and having its top plate



substantially flush with the top surface of the floor, holding bolts extending through the web portion thereof and the floor timbers at the opposite sides, and holding bolts connecting said girder and said keel, substantially as described. Five claims.

1,224,678. MARINE VESSEL. ERNEST L. SONS, OF PITTSBURG, PA., ASSIGNOR OF ONE-HALF TO SAMUEL A. BOYD AND ONE-FOURTH TO WILLIAM L. McCANDLESS, BOTH OF PITTSBURG, PA.

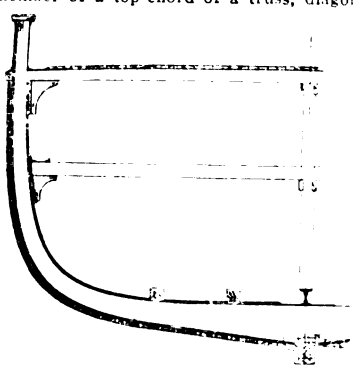
Claim 1.—A marine vessel comprisng a hull including an inner and outer frame and further having a deck floor formed of an upper and lower section, a series of independent rows of air containing casings interposed between said frames, a series of independent rows of air containing casings interposed between said floor sections, each of said casings having one wall depressed to provide a longitudinally extending groove, an inlet valvular device mounted in the bottom of each of said grooves, and a series of independent air supply pipes, each of said pipes common to a row of casings, positioned in the grooves of and connected to the valvular device of the casings of the row. Two claims.

1,228,914. APPARATUS FOR RAISING SUNKEN SHIPS. EUGENE S. HAYFORD, OF NEW ORLEANS, LA.

Claim 1.—An apparatus for raising sunken ships, including a collapsible and inflatable envelop, means for supplying air thereto, and an auxiliary inflatable envelop mounted therein and constituting a buoyant support for the main envelop. Four claims.

1,231,232. SHIPBUILDING. FRED A. BALLIN, OF PORTLAND, ORE.

Claim 1.—In a wooden ship, a metal bulwark plate above the main deck line that forms a member of a top chord of a truss, diagonally



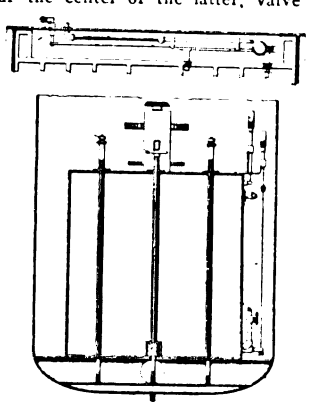
disposed planking and wooden frame sections that form the sheer members of the said truss and means for joining the several parts together with the bulwark plates exposed. Nine claims.

1,232,619. SHIP STABILIZING AND ROLLING APPARATUS. ELMER A. SPERRY, OF BROOKLYN, N. Y., ASSIGNOR TO THE SPERRY GYROSCOPE COMPANY, OF BROOKLYN, N. Y., A CORPORATION OF NEW YORK.

Claim 1.—A stabilizing device for ships and other devices subject to similar oscillations comprising a gyroscope, and means brought into action by precession of the gyroscope for exerting a stabilizing effect upon the ship. Thirty claims.

1,232,667. SUBMARINE VESSEL. ALPHONSE FERNANDEZ, OF WASHINGTON, DISTRICT OF COLUMBIA.

Claim 1.—A submersible vessel having a plurality of longitudinally spaced submerging chambers, a water passage extending longitudinally of the vessel and having a water inlet at or near the center of the latter, valve means



for closing said inlet, and additional valve means for closing said passage on either side of said inlet to exclude water from either end of the ship. Ten claims.

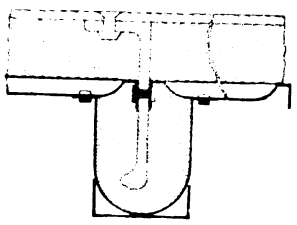
1,227,285. DRAFT INDICATOR. JOHN MAHER, OF CLEVELAND, OHIO, ASSIGNOR OF ONE-FIFTH TO EUGENE QUIGLEY AND ONE-FIFTH TO JOHN J. McKEE, BOTH OF CLEVELAND, OHIO.

Claim 1.—A draft indicator comprising the combination with a vessel, of a scale having graduated indicia corresponding with the depth of the hull, a member supported adjacent said scale and provided with openings spaced as said indicia, and a water gage communicating through said hull, said gage carrying projections adapted to co-operate with different pairs of such openings whereby an adjustment in the direction of alinement of said graduations may be effected. Twelve claims.

British patents compiled by G. F. Redfern & Co., chartered patent agents and engineers, 15 South street, Finsbury, E. C., and 10 Gray's Inn place, W. C., London.

107,078. "IMPROVEMENTS IN AND CONNECTED WITH THE FITTING OF ASBESTOS INSULATION IN ALL CLASSES AND PARTS OF SHIPS." A. BEAN, OF 1, SHANDON STREET, GOVAN, GLASGOW.

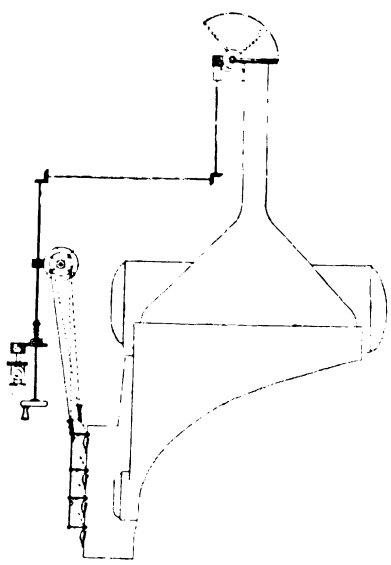
The invention relates to the fitting of asbestocel insulation, by which is meant hard or slate-faced asbestos insulation in all classes and



parts of ships, and has for its object to simplify the method of fixing the asbestocel slabs in position and to prevent the sagging of the same. With this invention, all cementing and plastering when the insulation is being fitted is dispensed with.

108,416. IMPROVEMENTS RELATING TO SUBMARINE VESSELS. H. E. YARROW, OF MESSRS. YARROW & COMPANY, LIMITED, OF SCOTSTOUN, GLASGOW, SCOTLAND, ENGINEER.

The invention relates to the closing of the top of the funnel of a submarine vessel when it is intended to submerge the vessel. A hinged valve is provided which can be operated from within the submarine to close the funnel



aperture when the vessel is submerged, and the means operating the valve are, either, so arranged that at the first motion the oil fuel is shut off from the burners, the air doors are then closed to prevent the products of combustion from escaping into the stoke-hole, and finally the funnel aperture is closed to prevent access of water, or these operations are performed simultaneously.

107,346. "SHOCK REGISTER FOR SHIP'S STEERING GEAR." F. O. STOREY, 9, SYDENHAM ROAD, STOCKTON-ON-TEES.

The object is to improve the method of resisting the shock produced by the action of the sea on the rudder of a ship. A crosshead, having two projecting rams, one at each side,

which enter into the hydraulic chambers, moves in a guide and is connected to the tiller or quadrant by means of a sliding socket pivoted on a pin secured to the tiller or quadrant.

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